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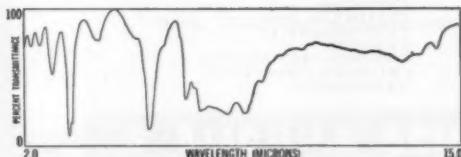
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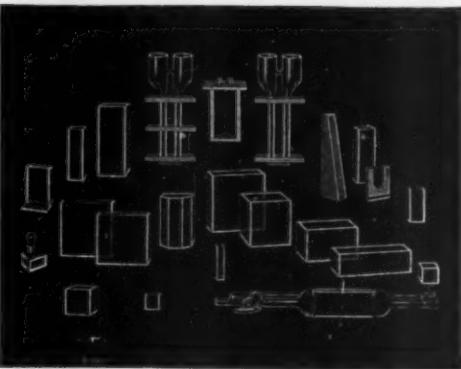
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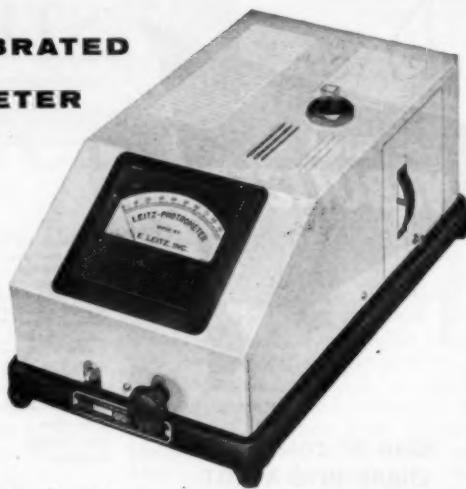
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On Certain Loyalty and Security Hearings

IN the dialogue *Gorgias*, Socrates held conversation with Callicles, a politician who believed that the law of nature favors the strong, determined, and unscrupulous man who takes what he can get without regard for the rights of others. To Callicles, success lay in pandering to the prejudices of the people and in rhetoric that appeared to lead them when in reality it only followed the fickle whims of the Athenian Demos. But Socrates urged upon Callicles and his friends the conclusion that the highest thing in life is not to secure immediate pleasure or even success but rather to discover and to do the really good; and, he further urged, only the love of wisdom can teach us what is good.

In these present days of loyalty investigations and security hearings, it seems appropriate to read again the great myth of the judgment with which Socrates concluded his plea. When Zeus became lord of the gods, it seems that judgments regarding who should go to the Isles of the Blest when dead, and who to Tartarus, were made while men were yet alive. Pluto and the stewards of the underworld complained to

Zeus that wrong people were going to both places. Then Zeus said: "Well, I will put a stop to that. Cases are judged badly now because those who are tried come to judgment with their clothes on and invested with fine bodies and lineage and wealth, and when the trial takes place, many witnesses come forward to testify that they have lived righteous lives. So the judges are dazzled by these, and at the same time they are clothed themselves when they give sentence, their eyes, their ears, and their whole bodies acting as a screen before their souls. They have all these hindrances before them, both their own clothing and that of those on trial. . . . They must be stripped naked of all these things before trial . . . and the judge must be naked too . . . that his verdict may be just."

Nothing could be clearer than that our present procedures succeed splendidly in stripping away the last shred of concealment from the judged. The failure of complete justice to be done implies that the other stipulation made by Zeus needs also to be heeded.—B.G.

*Now, as we have been told so often in the past few years, a citizen has no right to a job on the public payroll. But he is entitled to protection against harassment and loss of livelihood by executive department loyalty procedures that violate the essence of his constitutional rights. The independence of the elector draws the same clear boundary around the matters that may be legitimately inquired into by legislative committees. Officials and legislators who overstep this boundary are guilty of invading the integrity of the fourth branch of our government [namely, the sovereign citizenry, acting in its capacity as the electorate] and stand in contempt of the electorate.—GERARD PIEL, "Scientists and other citizens," *Sci. Monthly* 78, 131 (1954).*

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In the last two decades, the electronic recording of speech for use as scientific data in investigations of human behavior has rapidly increased. Earl F. Zinn made the first consistent attempt at recording psychotherapeutic interviews. In the 1930's at the Institute of Human Relations, Yale University, he recorded lengthy cases on Ediphone cylindrical disks. Carl Rogers and coworkers were pioneer psychologists in the systematic use of the technique and data in the study of psychotherapy. This group has continued to use them intensively. Especially since the end of World War II, sociologists, psychologists, and psychiatrists have increasingly exploited sound-recording techniques. Technical advances in recording devices and the improved methods of acoustically treating interviewing rooms have made it possible to realize the desire of many for objectivity of interview data.

At Yale, as elsewhere, the first attempts to record interviews utilized low-fidelity recording systems operated under noisy conditions. The early recordings by Redlich, Dollard, and Newman (1) were replete with sounds of flushing toilets, footfalls, rumblings of trucks, and so forth, which were transmitted into the clinic interviewing room where the recording occurred. To obtain useful speech recordings in these noisy surroundings, it was necessary for both therapist and patient to speak directly into individual microphones. At one time these were even held close to the participants in a halter.

A great deal can be learned, and was, from low-quality systems. Transcripts can be made and subjected to detailed content analysis. One can monitor live interviews or listen to these recordings for self-teaching and the instruction of small groups. But frequently crucial verbal productions, for example, near-whispers, are lost even in transcripts, and the general intelligibility is such that listening in small groups becomes a fatiguing and unpleasant task, with reasonably satisfactory reproduction before a clinic group or class of 30 or 40 students virtually impossible. Emotional nuances in the voices are not easily detected, and the people engaged in the interview in a room with poor acoustical characteristics must work so near the microphone that they are generally "mike bound." In addition, poor-quality recordings are not satisfactory for subsequent reproduction, in the form of long-playing phonograph records, for example, and distribution to the professional and scientific public. This was regarded as one of the main advantages of the use of recording procedures in interviewing. Gill *et al.* (2)

have published such records now. Early experiences with these difficulties have increased the interest of the behavioral scientists in reasonably high fidelity recording systems—comparable to a good original radio production.

The limitations cited in the preceding paragraphs can be overcome by carefully planning the entire system and by the availability of adequate funds. Many behavioral scientists who contemplate building facilities for reasonably high quality sound recording are not aware of the problems and solutions involved. This article describes essential features of a system (3) designed for use primarily by psychologists and psychiatrists. It is hoped that others may profit from this description as we did by inspecting facilities elsewhere and by the advice of others. It is not intended to present a plan to others that will dispense with the need for expert advice or to endorse in blanket fashion equipment found suitable in these particular circumstances.

Once the decision was made to build high-fidelity facilities, experts in the field of speech, speech recording, and acoustical architecture were consulted. Very valuable advice was obtained from the research staff of the Bell Telephone Company, the Psycho-Acoustic Laboratory and Department of Social Relations of Harvard, C. V. Hudgins of the Clark School for the Deaf, and the Haskins Laboratory. Recommendations from these sources, the services of an expert consultant (4), and the previous experience of Redlich, Dollard, and Newman resulted in the sound-recording rooms, which are illustrated diagrammatically in Fig. 1. Our experience has been that the steps followed have resulted in a generally satisfactory, though not perfect, instrument. The basic requirements for recording interviews in which speech varies in volume from mere whispers to loud talking may be briefly outlined as follows:

1) The background noise must be reduced to permit a very wide dynamic range reproduction and still have the reproduced sound louder than the background noise of the entire recording system. (This includes all noise introduced in the acoustical, mechanical, and electrical portions of the recording and playback systems).

2) A uniform reproduction (through the entire system) of all tones from the lowest base to the highest pitch of the overtones of the recorded sounds is required. These overtones carry much of the meaning and intelligence in the afore-mentioned emotional nuances.

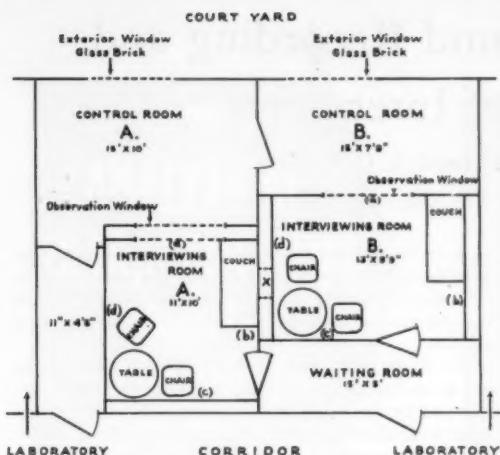


Fig. 1. Diagrammatic illustration of facilities. Point X is illustrated in detail in Fig. 2.

3) There should also be a minimum distortion of the wave-shape of the recorded sound waves. An excessive amount of wave-shape distortion disturbs the relative intensity relationships of the fundamental tones and their associated overtones, thereby reducing the ability to interpret emotional nuances correctly.

Location of the Suite

The location of the suite was the first decision and was carefully considered. The location was easily accessible and relatively quiet in comparison with other feasible areas. There was not another storey overhead. The site was reasonably distant from large pieces of machinery, such as elevators and ventilation blowers. Inspection of the building blueprints and the actual location showed that the walls of the area did not, as many do, contain pipes of the general heating, plumbing, or ventilation systems, which would be sources and transmitters of noise. The initial average noise level of the area was 58 to 60 db of acoustic power (5).

Plan and Construction of the Suite

A common waiting room and two interviewing rooms with adjacent control rooms for monitoring and observing make up the suite. Control room A was intended to serve also as a high-fidelity listening room. Each interview-control room unit is equipped with its own microphone-tape recorder-monitoring-playback systems. All rooms are air-conditioned.

Sound isolation of the interviewing rooms. The goal was to have an average noise level of 35 db in the interviewing rooms and to eliminate frequent loud noises caused by impact. With the type of construction described in this section, the average noise level is 46 db in acoustic power. The sound level, which is the apparent loudness to the human ear of this noise level, is less than 24 db, the lower limit of measurement of

a standard sound meter used in making the measures. These measures were taken 2 years after the use of the facilities started, with no readjustments of the doors to the interviewing rooms being made to insure maximal sound isolation.

Maximal sound isolation is achieved by "floating" one room with another. This plan was not followed because we had chosen a reasonably quiet location and had decided to reduce impact noises at their source when such noises became objectionable. We felt that under these particular circumstances the cost of the floating-room construction was too great for the gain in sound isolation that would result. Double-wall construction was required, however, and if there had been another floor above, a double ceiling and a specially constructed floor would have been required. Interviewing room A is isolated on all sides by double walls. On three sides the construction is of the type shown in Fig. 2. On side d (Fig. 1) the "double walls" are separated by a 4.5-ft air space, which also serves as a corridor to the control rooms. Interviewing room B is separated on two sides by double-wall construction as is shown in Fig. 2. The waiting room on side c (Fig. 1) serves as a double wall or sound lock. Sound-absorbent tile covers the ceiling of the waiting room. Side a (Fig. 1) separating the interviewing and control rooms B is only a single masonry wall. It was the original intention to use this control room for only quiet observation and to use suite A if the observation was to require loud monitoring or conversation among observers. The single wall is a serious limitation to the use of control room B, and it is desirable to add a second wall. Double doors separate each interviewing room from the waiting room. One of each pair is a heavy door designed to produce a transmission loss of 35 db. All doors are "weather-stripped" with rubber and felt gaskets and are equipped with bottom closures. After proper adjustment, they all close with the gasketing under compression.

Steps were taken to reduce noises originating in and transmitted through the corridor. A layer of $\frac{3}{8}$ -in. foam rubber faced with durable plastic covers the corridor floor and acoustic tile covers the ceiling. All the

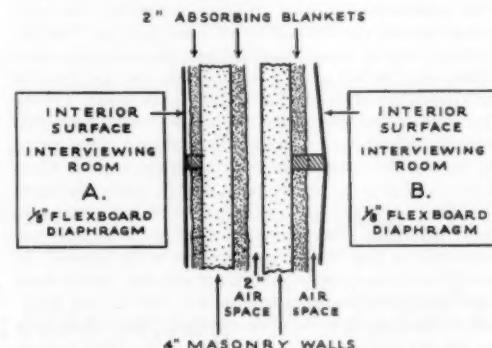


Fig. 2. Diagrammatic sketch of double-wall construction at point X in Fig. 1 (horizontal plane).

frames of doors opening out into this corridor are equipped with rubber cushions to reduce the noise of door closing.

The air-conditioning system is designed so as not to raise the background-noise level of the interviewing rooms. The following are the essential specifications of the system. (i) The maximum velocity of air at the supply and return grills is 150 ft³/min. (ii) The compressor, plumbing, and blower are by most standards quite far from the supply grills, 35 to 50 ft. (iii) The mechanical units are separated from the building structure and from the duct system by vibration isolators and are in a closet with acoustic tile on the ceiling. (iv) The entire duct system is lined with sound-absorbent materials. There are at least two right-angle turns in each supply and return line. (v) The ducts are isolated for vibration from the walls of the interviewing rooms. (vi) The supply and return systems of the combined control areas, each interviewing room, and the waiting room connect only at the blower. Feature i eliminates high-velocity air-whistle noises; ii, iii, iv, and v reduce to a minimum the noise transmitted into the interviewing rooms from the blower and compressor as well as air-velocity noises; iv and vi prevent the transmission of noises from one room of the suite to another by way of the air-conditioning ducts.

Interior acoustic treatment of rooms. Rooms that are relatively isolated from external noises still must be treated on the interior to obtain satisfactory reverberation characteristics—a minimum of deadness, boominess, and so forth. The desire was also to have rooms as natural looking as possible. The major items in achieving these ends are the type and amount of sound-absorption material applied to the interior of the rooms. Figure 2 illustrates the type of treatment used on the interior surfaces of the rooms. The 2-in. absorbent blanket referred to in this figure covers the entire ceiling and all walls down to a height 36 in. above the floor. (Of course, the furniture, rugs, and occupants of the room also contribute to the total sound-absorption properties of each room).

Sound waves striking the thin flexboard are transmitted diaphragmatically to the absorbing blanket fastened to the interior surface of the masonry walls behind the diaphragm. Some of the lower frequency sound waves are absorbed by the blanket, while most of the higher pitch sounds are reflected back into the room. The proportion of sound at various frequencies absorbed by this diaphragm-blanket treatment varies and is dependent upon the resonance of the diaphragm. This is indicated in Table 1 by the varying absorption coefficients at various frequencies. Most room furnishings and peoples' clothing absorb high-pitch sounds to a greater degree than low tones. The diaphragmatic treatment, having opposite characteristics, compensates for this effect, thereby equalizing the reverberation time of the room at various frequencies in the critical range. Theoretical reverberation times of the furnished rooms occupied by two people are also presented in Table 1.

As a result of the relatively sustained reverberation

time at the higher frequencies, these reasonably quiet rooms with low average reverberation time sound "natural and lively" rather than ominously quiet. The material customarily used for interior acoustic treatment has absorption properties that are just the reverse of the diaphragm-blanket. When the former is used in a quiet room, the result is often a "boomy" or "evernous" sounding environment. This is unsatisfactory, both from the standpoint of the immediate experience of participants in the room and the quality of the speech recording and reproduction. Our selection of this type of treatment was also determined by the flexibility for using the uniform and paintable surface of the diaphragm panels in the interior decoration plan.

Two precautions were taken to reduce standing waves in the rooms that contribute to distorted recordings. First, the dimensions of the rooms were chosen so that the resonating properties would be spread throughout the sound spectrum. Second, there are no opposing parallel surfaces within the interviewing rooms. Slight "zigzagging" of the flexboard surfaces of two adjacent walls and the ceiling accomplished this. The peaks and valleys in these surfaces are 4 ft apart, and the pitch is 2 in./4 ft (Fig. 2). The irregularity of these surfaces is not noticeable to most people except upon close examination. This feature also permitted the use of the microphone at a much greater distance from the participants than would be otherwise possible. The interior treatment described for the interview rooms was also used in control room A to increase the listening quality.

The observation windows. The construction of the window for the A suite is shown in Fig. 3. The other window differs in that the second masonry wall and its corresponding thermopane unit are omitted. The one-way vision mirror transmits approximately 10 percent of the light falling on its surface. When the control room is darkened and the interviewing room is illuminated, the light transmission into the control room makes it possible for observers to see the people in the interviewing rooms. The latter cannot see the former under these illumination conditions, for there is no appreciable light to be transmitted from the control room to the interviewing room. The one-way vision mirror itself provides practically no sound isolation. The sound isolation is provided by the thermopane units. They are especially necessary if there is to be freedom of movement and conversation in the observation areas. The thermopane units are mounted at angles, each slightly different, to improve visibility and to decrease resonating vibrations in the thermo-

Table 1. Theoretical absorption coefficients of diaphragm-blanket treatment and theoretical reverberation times of interviewing rooms.

Frequency (cy/sec)	128	256	512	1024	2048	4096
Absorption coefficient	0.32	0.26	0.20	0.20	0.09	0.05
Reverberation time (sec):						
Room A	.21	.24	.26	.25	.33	.34
Room B	.40	.45	.42	.35	.45	.45

pane and mirror elements. Each of these glass elements is mounted in felt under compression.

The height of the window is such that a person of average height seated in the interviewing room must look up at an angle if he is to see an inadvertently illuminated observer. This in turn requires that the observers' chairs be somewhat elevated for complete visibility of people in the interviewing rooms.

The window is large enough to accommodate six seated observers. Three of them sit in comfortable upholstered occasional chairs, all placed on a platform, and three on tall stools. Each window is equipped with a shade, which is raised only if an interview is actually being observed. Otherwise it is drawn, and the control area may be illuminated for other activities while an interview is recorded.

Recording-Playback System

The recording-playback system is of reasonably high fidelity to match the acoustic quality of the interviewing rooms (6).

Microphone and microphone placement. The microphone is one of the highest fidelity commercial units. It is omnidirectional and free of transients over the relevant frequency range. A single microphone is mounted in a table lamp in each interviewing room. The table tops are covered with a cork mat, which does not reflect enough sound to distort the speech signal near the microphone. The porous lamp shade permits

passage of the signal to the microphone. It will be recalled that the absorption blanket stopped 36 in. above the floor. The microphone is placed so that the sensitive element is 10 in. higher than this point. Under most recording conditions involving two people, the microphone is 3 to 4 ft from their mouths and is at lip level.

The only reason for placing the microphone in the lamp is to remove it as a constant visible stimulus. No attempt is made to conceal its presence from the patients. They are told of it and, upon close inspection, can see the microphone cable running from the base of the lamp.

Wall sockets and conduits for connecting the microphone with the recording equipment were built in the masonry walls as they were constructed. Each room is equipped with three wall sockets for flexibility in microphone placement. If necessary, all three may be used simultaneously.

Recording equipment. Each control room is equipped with a tape recorder. The amplification-recording system has a signal-noise level ratio of 35 db, and it records and plays back with no significant variation in decibel level and other forms of distortion up to 7500 cy/sec when the tape speed is 7.5 in./sec. This frequency range is adequate for high-fidelity speech recording. The recorder handles 2400-ft reels that give 1 hr of continuous recording at a tape speed of 7.5 in./sec. The recorder will also operate tape at 15 in./sec, but it has not yet been necessary to use this recording speed.

Playback and monitoring. The system provides for (i) listening to and observing an interview without recording it, (ii) simultaneously recording, listening to, and observing, (iii) doing either of the preceding and also recording comments by observers on a second recorder, (iv) recording only. Twelve-inch speakers are used for monitoring and all later listening in the control room. The fidelity of the speakers and their amplifiers is commensurate with the rest of the system.

Remote control. Some interviewers wish to have a technician in the control room start the recording equipment. Other interviewers prefer to start and stop the recording equipment themselves, in the presence of the patient. Each interviewing room is equipped with remote-control switches that may be used for this purpose. When not in use, these remote control units may be handily removed from the rooms.

Additional Features

At the time of construction, continuous copper shielding was placed on the masonry walls, floor, ceiling, and door of interviewing room A. A shield for the observation window may be inserted into the continuous shield. Also a blank 2-in. conduit in wall d (Fig. 1) connects this room and its control room. These features provide for pneumatic and electronic polygraphic recording, which may be synchronized with speech recording.

The facilities are used for both research and teaching by and for psychologists and psychiatrists. Re-

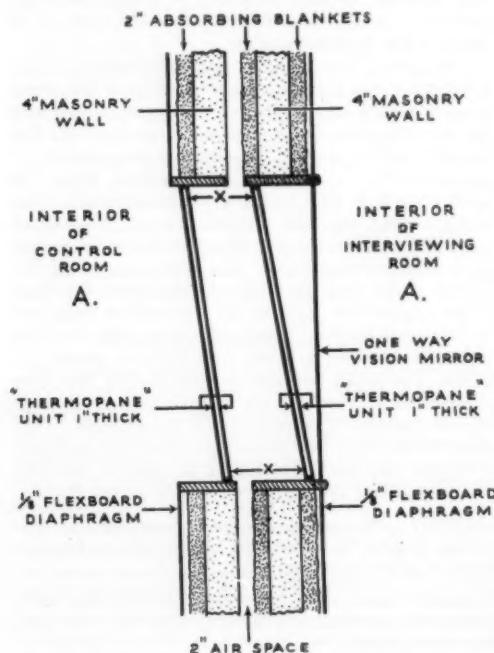


Fig. 3. Diagrammatic sketch of construction of observation window of interviewing room A (vertical plane).

search is given first priority in these rooms. The overflow of teaching needs is met by the use of additional lower fidelity facilities. Transcripts of recordings, recordings, and live observations have been instrumental in pursuing such problems as the investigation of supervision of psychotherapy, clinical and objective studies of the intake interview, clinical and objective analyses of continuously recorded individual and group psychotherapy, an experimental study in hypnosis, and an investigation by structured interviews of the psychodynamics of pregnant women. Recordings and/or live observations are used for individual supervision of psychotherapy and psychological testing, for teaching to small observation groups as well as larger seminar and clinic conference groups, and for self-teaching.

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3. Grants by the John and Mary R. Markle Foundation and the Social Research Foundation, Inc., to Dollard and Redlich made possible the construction and use of these facilities. The preparation of this description was possible because of aid from the Foundations Fund for Research in Psychiatry.
4. E. J. Content, registered acoustic and radio engineering consultant, Stamford, Conn., was our expert consultant for both the acoustic and electronic aspects of the project. He was also kind enough to check the technical details in this article. Robert Coolidge, New Haven, Conn., designed the decor. E. J. Behler, superintendent of maintenance, construction, and stores of Yale University cooperated in the project. We wish to express our appreciation to these individuals.
5. Acoustic power, or intensity, is commonly measured in watts per square centimeter. Because such measurements have an extremely wide range of values, they are converted into and expressed in decibels for convenience. The conversion relationship is defined as follows: decibels = $10 \log_{10} \frac{I}{I_0}$. In the decibel measurements in this paper, $I_0 = 10^{-12} \text{ w/cm}^2$ and I is the energy level in the interviewing rooms. The sound meters are calibrated and equipped with scales to give the decibel readings directly.
6. We selected Ampex and Altec equipment at all points in the system.



The Rare Human Isoagglutinin Anti-Tj^a and Habitual Abortion

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In 1951, Levine *et al.* (1) described a remarkable isoantibody in the serum of a 66-yr-old female patient suffering from gastric adenocarcinoma which hemolyzed or agglutinated each one of more than 5000 random bloods of all groups and Rh types except the blood of her 45-yr-old sister who was physically normal (family I, Virginia, U.S.A.; cases 1 and 2; see Table 1). It was assumed that the antibody, anti-Tj^a, by virtue of its hemolytic nature was of the immune variety, in spite of the fact that the patient was never transfused and none of her four full-term pregnancies ended in hemolytic disease. Since the antibody could not be demonstrated in the serum of the compatible sister (case 2) when tested in 1951, it was suggested that the tumor could perhaps supply the antigenic stimulus. Indeed, absorption experiments on a limited scale carried out with minute amounts of the dried tumor cells and antibodies for several different human blood factors seemed to indicate a specific affinity of the tumor and anti-Tj^a.

In 1952, the same antibody was identified by Zoutendyk and Levine (2) in the serum of a 38-yr-old white South African patient (case 3) who had four consecutive miscarriages. This observation and the fact that in 1953 the antibody could be demonstrated in the serum of the physically normal sibling of the Virginia family I (case 2) made it necessary to re-appraise the relationship of the tumor and the presence of anti-Tj^a.

In any event, anti-Tj^a is found in the serum of individuals who are homozygous for the very rare gene, Tj^b, that is, Tj^bTj^b. It was assumed that both parents are heterozygous, that is, Tj^aTj^b, so that 25 percent of the offspring may be Tj^aTj^b and could possess or potentially produce anti-Tj^a. The presence of the very rare gene Tj^b in both parents suggested the possibility of consanguinity, and indeed a history of cousin marriages was elicited in family I and in family V.

In rapid succession anti-Tj^a was found in five other families in Australia (3), Poland (4), the United States (5), Canada (6), and Japan (7). In two of these families, this rare antibody was present in two siblings each, and in the Japanese family it was found in four siblings. Some of the essential details in the seven families with 13 examples of anti-Tj^a are listed in Table 1.

The Australian family was reported by Walsh and Koopztzoff (3), who demonstrated anti-Tj^a in the serums of two young physically normal sisters, not married when the first observations were made. The serum of the older sibling agglutinated every one of 2900 random bloods tested, 1208 whites and 1692 natives of South Korea and the Pacific islands. The older of the two siblings, now married, lost her first pregnancy and is currently in her second pregnancy. Walsh and Koopztzoff (3), however, failed to confirm the specificity of the absorption of anti-Tj^a by tumor cells from the Virginia patient (case 1).

The Japanese family studied by Iseki and Masaki, of Gunma University, Maebashi (7), is most remarkable, because anti-Tj^a was found in four out of five siblings, two brothers and two sisters. The older sister (Rit. Ho., case 10) is married, and each one of her six pregnancies ended in a miscarriage at 2 to 5 mo. The antibody in each of four cases was identified in tests of both serum and red cells sent by airmail to us. As in the other cases, the red cells failed to react with anti-Tj^a from cases 1, 2, 7, and the antibody in the serums of the siblings. Furthermore, the Japanese serums reacted with numerous random bloods except that from case 1.

Anti-Tj^a must be differentiated from another rare and remarkable antibody, anti-H, produced by individuals of the rare genotype *OcOc* (8). Both antibodies hemolyze or agglutinate all random bloods tested, but their specificities have been shown to be distinctly different. This form of anti-H, which has been found in only three group-O male natives of India (all *Le^a* positive) (9), is inhibited by secretor substances (saliva) which do not influence the activity of anti-Tj^a. The reactions attributable to anti-Tj^a appear to be independent of O, A (probably also B), MNSS factors, and the Rh or secretion status.

Anti-Tj^a is active at 37°C and, in almost all instances, hemolyzes red cells. Upon inactivation, only agglutination is observed, but hemolysis may be restored by adding group-compatible, fresh serum. The maximum titer in the case reported by Zoutendyk and Levine was 1:128 at 37°C, but in most instances lower values of 1:2 to 1:16 were observed at this temperature. In spite of its hemolytic nature, optimal agglutination in the several cases in which comparative titrations were carried out at 18° and at 37°C occurred at the lower temperature. Lesser degrees of hemolysis were observed at 18°C.

As was to be expected from its capacity to hemolyze red cells, anti-Tj^a was responsible in at least one case for a severe hemolytic reaction after a test injection of 20 ml of incompatible blood (1). As a result of this antigenic stimulation, the titer increased from 1:8 to 1:512. The difficulty in finding compatible donors for any of the 13 cases, widely scattered over five continents, is obvious even without taking into account the OAB blood factors and the requirement that Rh-negative individuals, particularly females, must receive Rh-negative blood.

Reference to the summary presented in Table 1 reveals the following facts: (i) Anti-Tj^a is present in the serum of all 13 individuals whose red cells, of genotype *Tj^aTj^a*, do not react with the antibody. (ii) A history of a tumor is evident only in the older of the Virginia siblings (case 1). (iii) The antibody was present in three male individuals in families V and VII. (iv) Only the Virginia siblings—the oldest of the group—had normal full-term pregnancies with surviving offspring. (v) Among the five married women of childbearing age, there are a total of 18 pregnancies, each one of which ended in a miscarriage at 2 to 5 mo.

There is undoubtedly a causal relationship of this pregnancy wastage and the presence of anti-Tj^a. This is all the more remarkable, since antibodies for Rh and other blood responsible for hemolytic disease do not cause early fetal death. It is characteristic of classical hemolytic disease that only the fully or almost fully developed fetus or infant is affected, in spite of the fact that the responsible antibody in high titer may be present throughout the course of the pregnancy. This state of affairs applies also to anti-A and anti-B, and although ABO incompatibilities are suspected of playing some role in causing early miscarriages, the evidence is indirect and not yet con-

Table 1. Thirteen examples of anti-Tj^a in seven families. The parents of the siblings in families I and V are first cousins.

Family	Location	Case	Sex	Age	Blood group	Obstetrical history	
						Full-term	Abortions
I	Virginia, U.S.A.	1. DJ*	♀	66	O	4, l & w†	0
		2. BD	♀	45	O	7, l & w	0
II	South Africa	3. MC	♀	37	O	None	4
III‡	Australia	4. —*	♀	23	O	None	1
		5. —	♀	19	O		
IV	Poland	6. Za	♀	30	A	None	4
V§	Michigan, U.S.A.	7. EE*	♀	30	O	None	3
		8. GG	♂	36	A		
VI	Canada	9. El	♀	33	O	None	0
VII	Japan	10. Rit. Ho*	♀	27	A	None	6
		11. His. Hag	♀	22	A	None	0
		12. Yoi. Hag	♂	17	O		
		13. Yas. Hag	♂	14	O		

* In the four families with more than one example, the asterisk refers to the first sibling in whose serum the antibody was first found. This observation led to the study of the serums of the siblings.

† l & w indicates "living and well."

‡ The red cells of the parents and four other siblings reacted with anti-Tj^a.

§ The red cells of the parents and one other sibling reacted with anti-Tj^a.

vincing (10, 11). In the vast majority of ABO incompatible matings, the pregnancies go to term, and the infants, with occasional and rather unpredictable exceptions, do not suffer the effects of hemolytic disease.

Possibly anti-Tj^a may be considered as a naturally occurring antibody, as indicated by its presence in the serums of three male individuals who were never transfused. On the other hand, anti-Tj^a which was not found in case 2 in 1951 was demonstrable 2 yr later. If there is a direct relationship of anti-Tj^a and miscarriages, then one must conclude that the antibody was also not present during her childbearing age, when she had seven full-term infants, and the same considerations apply to her older sibling, who had four normal children. There is, however, no evidence to support the assumption that a form of anti-Tj^a exists which fails to penetrate the placental barrier.

The pregnancy wastage of 18 consecutive fetuses suggests a lethal effect specific for the heterozygote Tj^aTj^b , but exceptions must occur because it is the double heterozygous mating that is the most likely source for the rare genotype Tj^aTj^b , and this indeed is established for at least two of the families, III and V (Table 1). With a very low frequency for gene Tj^b , the chances are that also in the remaining five families the parents are both heterozygotes. Assuming a frequency of 0.1 percent for gene Tj^b , the ratio of Tj^aTj^b/Tj^aTj^b is 1998 : 1.

In any event, the data presented indicate that a very rare antibody, specific for a blood factor present in almost all bloods, may be responsible for habitual abortion in certain patients. Such a mechanism, however, can hardly explain the vast majority of early pregnancy wastage, unless future studies reveal the presence of antibodies not detectable by methods currently employed.

The concomitant presence of anti-Tj^a with the red cell structure of genotype Tj^bTj^b , in the absence of

obvious antigenic stimuli, provides an analogy to the Landsteiner rule governing the distribution of anti-A and anti-B in the scheme of the four blood groups. The same pattern is followed by the regular occurrence of a presumably physiologic antibody, anti-H, determined by the antigen structure $OcOc$, as recently described by Bhende *et al.* (8); and indeed, this antigen-antibody relationship is considered to be an integral part of the ABO (H) system. With regard to the apparent exception in case 2, it may be mentioned that examples of group A with complete or almost complete absence of anti-B have been observed (12). In the light of these facts, the failure in 1951 to demonstrate anti-Tj^a in case 2 may be more apparent than real, because exhaustive studies were not made to exclude the presence of the antibody in low titer and perhaps active only at lower temperature (18°C).

The sex distribution of anti-Tj^a, ten females to three males, does not indicate a sex relationship, because the 13 examples were not found in study of a random sample. A history of 17 miscarriages in four patients (4, 4, 3, and 6, respectively) suggested blood studies that led to the detection of anti-Tj^a in their serums and, incidentally, also in the serums of the three male sibs.

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Fred E. Wright: 1878-1953

FREDERICK EUGENE WRIGHT, for many years a petrologist on the staff of the Geophysical Laboratory of the Carnegie Institution of Washington, died on 25 August, 1953 at his summer home on Sagastaweka Island in the Thousand Islands. He was recognized as a pioneer in the development and application of optical methods for the identification of minerals, especially fine-grained ones such as are found in synthetic preparations. He was born at Marquette, Michigan, in 1878, and received his early education in that vicinity. He then went to the University of Heidelberg in Germany and in 1900 was granted the degree of doctor of philosophy. After serving successively as instructor in petrology at the Michigan College of Mines (1901-

04), as assistant state petrologist of Michigan (1903-04), and as state petrologist (1904-05), he came, in 1906, to the U.S. Geological Survey in Washington. About the same time he became associated with the Geophysical Laboratory and, after a few years, relinquished his formal connection with the Geological Survey.

The results of his researches in crystallography, experimental petrology, and related subjects are embodied in about 150 scientific papers. His book entitled *The Methods of Petrographic-Microscopic Research* (Carnegie Institution of Washington, 1911), now long out of print, had a powerful influence in stimulating interest in petrology and petrography by demonstrating the accuracy and practicability of

quantitative measurements with the microscope of the optical properties of crystals even as small as 0.01 millimeters on a side.

Dr. Wright is also internationally known for his systematic studies of the surface of the moon, especially by measuring the percentage of polarization of light reflected from various regions of the moon's surface. These studies were undertaken at Mount Wilson Observatory, where he spent several summers as a guest worker. His investigations supplied definite information concerning the nature of the materials on the moon. By the use of various methods, including a special polarization eyepiece for determining the amount of plane polarization at different points on the moon's surface and a photoelectric cell for the measurement of the amount of plane polarization and of the relative spectral intensities of the rays, he showed that the lunar surface materials are predominantly light-colored rocks. Furthermore, from thermal measurements in addition to the optical measurements, he showed that the surface materials are of the nature of volcanic ash and pumice with a high silica content.

He had an active and productive life, occupying many posts of high responsibility and accepting many important scientific assignments. During World War I he took an active part in the development of methods for the production of optical glass for which there was then a critical need for use in military devices, such as range finders, gun sights, and periscopes. His activities in this connection were carried out while he was serving as an officer in the Ordnance Department of the Army. In World War II he served

as civilian adviser to the Joint Optics Committee of the Army and Navy Munitions Board. He was president of the Optical Society of America (1917-19), of the Mineralogical Society of America (1941), and of the Geological Society of Washington (1924); vice president of the Geological Society of America (1941) and of the National Academy of Sciences (1927-31); and for 20 years was the Academy's Home Secretary.

In addition to the afore-mentioned memberships in societies, Dr. Wright was a Fellow of the American Association for the Advancement of Science and a Foreign Fellow of the Geological Society of London. He was also a member of the American Philosophical Society, the Astronomical Society of America, the American Physical Society, the American Academy of Arts and Sciences, the Physical Society of London, the Washington Academy of Sciences, the American Institute of Mining and Metallurgical Engineers, the Army Ordnance Association, the American Geophysical Union, and the Philosophical Society of Washington. He was a member of the Cosmos Club for nearly 50 years.

His efforts and accomplishments won him many honors. Among these were the granting of an honorary science degree by the University of Michigan in 1940, the award by the U.S. Army in 1945 of the Gold Medal for Exceptional Civilian Service, and the award by the Mineralogical Society of America in 1952 of the Roebling Medal.

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James Somerville McLester: 1877-1954

JAMES S. McLESTER, of Birmingham, Alabama, died 8 February, 1954, aged 78 years. He will long be remembered by his many patients, his students, and his colleagues for unusual integrity and kindness. The warm affection of former residents of the Hillman Hospital recently was expressed by their joining together in having his portrait painted for the University of Alabama. Those residing in Birmingham organized a "McLester's Residents' Club" and members of this club were the pallbearers at his funeral. The esteem of colleagues appears from his membership in many of the leading national societies as well as by his election in 1934 to the presidency of the American Medical Association.

McLester was one of several physicians who, having studied in the laboratories and clinics of Germany, in the days of their preeminence, before World War I, pioneered in introducing scientific procedure into the practice of medicine in America. This was lagging in those times, especially in the cities of the South and West. Some of these physicians, like McLester, were the giants of their localities—big in public spirit and

character as well as in scientific background, such men as Frank Billings of Chicago and Arthur Dunn of Omaha.

McLester's German training was in Göttingen and Freiburg in 1901-02 and in Berlin and Munich in 1907-08. He wrote few strictly scientific papers, but this German training was responsible for his subsequent insistence on rigid evaluation of clinical observations as well as for the early emphasis he placed on laboratory aids in diagnosis. He had been taught the Wassermann reaction by Wassermann himself, and a serologic test for syphilis had later been performed, he used to say, on every patient he had seen. The x-ray machine in his office was the second to be installed in Birmingham, and his electrocardiograph and apparatus for determining the basal metabolic rate were perhaps the first of these in use in Alabama. His Oxford monograph, *The Diagnosis and Treatment of Disorders of Metabolism*, appeared in 1935.

Teaching was a lively interest. He was instrumental in establishing at Birmingham a 4-year medical cur-

riculum, effected there in 1945. Much earlier, however, he had come to the conclusion that, while research was of extreme importance, a major service to be expected of medical schools in general was "to carry the newer things of medicine to the men upon whose minds must rest the burden of caring for the health of the people—the men in general practice." The school had two chief teaching functions, as he saw it: the first to give the facts; the second, to mold character and method of thought. Compensation for failure of the first might come in later life, not so with failure of the second. He wanted more emphasis on English composition, without which much good work is lost in confused reporting. He also was insistent on general culture, which, in his opinion, ought to be expected in physicians. This comes in large part, so he wrote, from contact with the broadly cultured teacher. These and many other searching comments are contained in addresses given at meetings of the Council on Medical Education and Hospitals.

His clinical interests were broad. Psychosomatic medicine, so greatly emphasized in recent years, was no novelty to him. He was writing locally in 1906 on the mental attitude of the physician with patients who had tuberculosis, and he emphasized repeatedly thereafter, both to surgeons and physicians, that their first responsibility was the patient, not disease.

McLester's burning interest in nutrition seems to have begun in the early 1920's with his concern for sufferers from mild neuroses, "neurasthenies," as they then were called. Many of his patients improved greatly under rest and better diets, and he was led to place great emphasis on the contribution of diet. He

was among the first to recognize that nutritional failure can be injurious long before a frank deficiency disease develops. "It is a principle of the school system in which I work," he wrote—he was medical director of the schools of Birmingham—"that in childhood even the development of character proceeds more surely in the presence of health and that good nutrition is prerequisite to health." This thinking led him to demand training in nutrition of pupil, teacher, and parent. So nutrition teaching was begun in the Birmingham schools and a school luncheon program started early there.

McLester served for nearly 20 years as chairman of the Council on Foods and Nutrition of the American Medical Association. In World War II he was a member of the Food and Nutrition Board of the National Research Council and chairman of its Subcommittee on Medical Nutrition. Physicians generally have been slow to grasp the importance of good diets for the maintenance of health and in the effective treatment of disease. McLester was untiring in his efforts to correct such apathy. His monograph, *Nutrition and Diet in Health and Disease*, ran through six editions. The first appeared in 1927, the sixth in 1952. He spoke repeatedly on this subject, most effectively perhaps, in his presidential address to the House of Delegates of the American Medical Association. Thus, he most emphatically deserved a special honor, received before he died from the Board of Trustees of that association: the Joseph Goldberger award, bestowed on him for outstanding contributions in the field of clinical nutrition.

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News and Notes

Leprosy

The 6th International Congress of Leprosy, sponsored by the Spanish Government with the collaboration of the International Leprosy Association, was held in Madrid, 3-11 Oct. 1953. The *International Journal of Leprosy* [21 (Oct-Dec. 1953)] carried an editorial entitled "Report on the Madrid Congress," as well as a list of registrants and the minutes of the meetings of the Congress council, of the plenary sessions of the Congress, and of the general meeting of the International Leprosy Association. In addition, there were complete reports of the various technical committees of the Congress and the authors' abstracts of most of the scientific papers presented.

The importance of leprosy in the world today is reflected in the number of international registrants at this Congress and in the titles of the numerous scientific papers presented.

The official registration list comprised 337 names. Compared with previous congresses, this represented a steady growth in registration—at the Cairo Con-

gress in 1938, the registration was 167, and at the Havana Congress in 1948, it was 226. The international atmosphere of the meeting was emphasized by the fact that 226 registrants were from countries other than Spain; 51 countries or important political subdivisions were represented. In addition to the official membership in attendance, there were a number of "adherent" registrants who accompanied regular members. The total attendance at the Congress was estimated to be 500.

Abstracts of 134 of the 166 titles listed in the program were published. About 25 percent of these abstracts were in English; the remainder were in Spanish, Portuguese, Italian, and French.

An interesting archeological-osteological study of skeletons excavated from a medieval churchyard in Denmark was reported. Patients from a leprosy hospital had been buried there between the years 1250 and 1550. From this study came the new observation that the anterior nasal spine of the maxillary bone was atrophic or absent in some cases of leprosy. This

atrophy of the anterior nasal spine has subsequently been observed in roentgenographic studies of patients with leprosy.

Of special interest was a preliminary report by representatives of the Leonard Wood Memorial of the first large-scale, controlled, global (Japan, Philippines, and South Africa) experiment in the treatment of leprosy. Sulfonyl and several other drugs were used, including dihydrostreptomycin. Treatment by a combination of drugs offered no advantage.

Though human leprosy has not been transmitted to animals, there were no reports at this meeting of any further attempts to reproduce the disease in animals.

No tissue culture experiments were mentioned. There were, however, two papers on attempts to cultivate the organism, concerning which the editor made the following comment:

Interest was especially centered, because of the publicity that had been given them, on two reports on bacteriology. One dealt with a *Mycobacterium*, isolated from a leprosy lesion but not claimed to be the causative agent of the disease, which certain other workers had used in leprosy patients to induce lepromin positivity and for treatment. The other claimed success in the cultivation of the leprosy bacillus through a stage consisting of a large, motile non-acid fast form.

The reports of the technical committees, which were published verbatim, should be of great value to those interested in any phase of leprosy. Since the membership of these committees was international, and since the reports, as published, were approved by the Congress as a whole, they represent data, concepts and opinions that have been subjected to the processing of an international clearing house of experts in the field of leprosy.

Classification committee. The most significant change made in the classification of leprosy was the recognition of the borderline (dimorphous) group. The official classification adopted by the Congress was as follows: lepromatous type (L), tuberculoid type (T), indeterminate group (I), borderline (dimorphous) group (B).

To aid in planning and evaluating treatment and in prognosis, the types and groups were further subdivided into varieties. The borderline (dimorphous) group was defined in part as

A malign form very unstable; almost always strongly positive on bacteriological examination; the lepromin reaction generally negative. Such cases may arise from the tuberculoid type as the result of repeated reactions and sometimes they evolve to the lepromatous type.

With the concept that the lepromatous and tuberculoid types include cases that clinically, immunologically, bacteriologically, and histologically would be placed at opposite poles, the borderline (dimorphous) group gives recognition to the fact, well known by experienced leprologists, that some cases of leprosy show characteristics of both types, and that skillful clinical management of such cases depends on proper classification.

Treatment committee. In the report of the 5th Con-

gress, held in 1948, sulfone therapy was recognized as a distinct advance in the management of leprosy. During the following 5 yr much has been learned about the use and effect of the sulfone drugs. The parent sulfone 4,4'-diaminodiphenyl sulfone (DDS), once considered too toxic for use in man, has been found safe and as effective as the more expensive compounds. While the exact mode of action is not clear, the sulfone drugs are apparently not bactericidal, but they may be bacteriostatic. In some centers, after prolonged treatment, clinical and bacteriologic arrest of the disease has been attained in a high proportion of cases, and it has been maintained over a period of years. In other centers, arrest has occurred in only a relatively small proportion of cases, and relapse has not been uncommon. The committee concluded: "Various observations indicate that arrested cases are not completely freed of the leprosy bacilli and that reactivation of the disease is, therefore, not unlikely."

Nearly all workers have abandoned the use of chaulmoogra oil in favor of sulfone treatment. Thiosemicarbazones, isonicotinyl hydrazide, and dihydrostreptomycin have not been as effective as the sulfonyl. ACTH and cortisone have been of value in treating serious toxic and allergic reactions to drugs. The local use of cortisone for eye complications has been of great value.

Immunology committee. For the first time, a committee report on immunology was presented to an International Congress of Leprosy. The prominence given to this subject was the result of the importance now ascribed to the lepromin reaction and the interest in B.C.G. immunization. The committee reported that

The use of lepromin reaction as an index of the degree of resistance to *Mycobacterium leprae* is constantly increasing. It offers a useful element in respect to prognosis and classification of cases of leprosy and, consequently, its use in practice is recommended.

The report discussed the various antigens now in use and gave the criteria for reading the reactions. (Since the lepromin antigen has to be prepared from leprosy nodules removed from patients, material for preparation of the antigen is difficult to obtain and standardization is unsatisfactory.) The committee further reported that

A positive lepromin reaction is regarded as an expression of a certain amount of resistance to *Mycobacterium leprae* directly proportionate to the degree of positivity.

With reference to the use of B.C.G. immunization in leprosy, the committee stated:

In leprosy patients a positive lepromin reaction not artificially produced gives, from the biological point of view, a favorable prognosis.

The administration of B.C.G. to healthy individuals who are negative to lepromin causes a change of the reaction in a large proportion of cases.

The question of whether or not a positive lepromin reaction, artificially induced by B.C.G., indicates immunity is being studied and, as yet, no conclusive statement can be made regarding the matter.

Epidemiology and control committee. The committee emphasized the need to continue determining the prevalence of the disease in those countries in which leprosy was endemic. There was a recommendation that the lepromin-negative contact be examined more frequently than the lepromin-positive contact; a similar recommendation had been made at the Havana Congress.

Among other methods for the protection and control of contacts, the committee recommended "Induction of lepromin reactivity by means of B.C.G." However, the general council proposed that this should be struck out, because B.C.G. is still in the experimental stage and there is no adequate evidence to justify the indicated view that it is an established method of prophylaxis. The final plenary session, nevertheless, voted for the retention of the statement. The committee reaffirmed

... that leprosy belongs to the group of infectious and contagious diseases and that, consequently, definite methods of control should be employed when dealing with it.

Social aspects committee. The committee approved the action of the Havana Congress, which condemned the use of the word "leper," but retained the term "leprosy" as the scientific name of the disease. It was recommended "that there be as little interference as possible with the normal lives and usual occupations of leprosy patients certified by leprologists as non-contagious...."

On raising the question of whether this big international meeting was worth while, the editor made the following comment:

After all there is always the question of which is more important, the scientific programs or the personal contacts, and many hold for the latter. As recently stated, [Council of American Physical Society, Nov. 1952, cited in *Science* 118, 311 (1953)], "The personal exchange of ideas and the collaboration of foreign scientists are essential sources of information and ideas which cannot be replaced by written correspondence or the study of foreign publications...."

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Science News

Vitamin deficiency is now known to be among the causes of at least 11 nervous or mental disorders, according to a report by Robert A. Peterman and Robert S. Goodhart in the *Journal of Clinical Nutrition*. Such striking symptoms as mental deterioration, hysteria, hallucinations, and even ideas of persecution, are listed as sometimes originating from a lack of certain vitamins, mainly the B vitamins, in the diet. Sometimes doses of 5 to 10 times more than the normal nutritional requirement of the missing vitamins are needed to help these patients. The report, written to make these findings available to practicing physicians, summarizes 74 separate studies.

Cortisone and hydrocortisone, hormones related to the adrenal cortex, produce significant elevations of blood fats, including cholesterol, when injected into the rabbit, according to David Adlersberg, Louis E. Schaefer, and Chun-I Wang in a paper scheduled for a forthcoming issue of *Science*. It is well known that cholesterol feeding in the rabbit results in extreme elevation of blood fats, especially cholesterol, and produces marked deposition of cholesterol in the arteries (atherosclerosis). The combination of cholesterol feeding with daily injections of the hormones results in even higher levels of blood fat than with cholesterol feeding alone, but also results in decided retardation of deposition of cholesterol in the arteries and other tissues. This effect is probably caused by diminished tissue permeability.

The New Jersey Resettlement Project, first statewide program in the nation concerned with the social and economic adjustment of displaced persons, is being continued this summer on a private interim basis. It was conducted jointly by the N.J. Welfare Council and Rutgers University with a \$10,000 grant from the East European Fund of the Ford Foundation until 30 June. Staff members will continue to work with recent immigrants on a voluntary basis until such time as the project acquires new sources of support.

In 1953, when gamma globulin (GG) was first made available for use against polio (after the 1951-52 field trials conducted by William M. Hammon of the University of Pittsburgh), there was a widespread belief that GG was "the complete answer to polio." Neither Dr. Hammon nor the National Foundation for Infantile Paralysis believed this to be true. Now the impression is growing that it is not effective at all. To correct public misconceptions about the use of GG, the foundation lists the following facts.

1) Gamma globulin gives limited and temporary protection against paralytic polio when injected under the proper conditions in the right amount and if timed properly. This year GG, because of new Office of Defense Mobilization regulations and the larger supply, can be given earlier and has a better chance to be effective.

2) About twice as much GG for polio, 2 million doses, is available this year. Distribution is based on local polio attack rates as compared with the country as a whole. Adequate supplies (2 million doses) are set aside for use against measles and infectious hepatitis.

3) From the end of the first week through the fifth week after injection, protection against paralytic polio was found to be 88 percent. There is strong evidence that significant protection also was provided from the fifth through the eighth week after injection.

4) Between 26 Apr. and 13 July extensive field trials were conducted on a potential vaccine developed by Jonas E. Salk, University of Pittsburgh; the trial vaccine, to be studied and evaluated during the remainder of the year, may provide long-lasting protection against paralytic polio. GG has never been given credit for more than temporary and limited protection.

5) GG is at present the only immunizing agent that has been proved effective against paralytic polio. It will be used this summer to prevent paralysis, but the results will be difficult to measure, since no one will be able to prove that any specific child would have had paralysis without GG.

The National Bureau of Standards is moving its **radio propagation division** from Washington, D.C., to Boulder, Colo. The new site offers better "laboratory" conditions in the form of mountains and wide, wind-swept plains. About 217 acres of land were donated to the NBS by Boulder citizens and civic groups. A new \$4 million building for research in radio wave propagation and radio standards was completed in May. Frederick W. Brown will head the new facilities. The Bureau already has a cryogenics laboratory at Boulder.

Fresh evidence that ancient Mexicans lived near Mexico City some 11,000 yr ago and hunted elephants now long extinct has been unearthed at the "reservoir of elephants" about 22 mi northeast of the city. The fossilized bones of the **second mammoth** and stone weapons that probably felled the beast were discovered in the dry lake, Texcoco, by Louis Aveleyra, director of prehistoric archeology at the Mexican National Museum, and Manuel Maldonado, paleontologist.

At the same site the first mammoth was found in 1952, together with obsidian weapons, and nearby, Mexico's ancient man, 11,000-yr-old Tepexpan Man, was found in 1947. Some of the fossil bones showed signs of having been worked on with stone tools. The weapons found with the discovery were three projectile points known as "atlatls." Somewhat larger than arrow heads, these points apparently were released from a shaft and shot into the animal's ribs.

Pickett & Eckel, Inc., Alhambra, Calif., has announced a new **conversion slide rule** bearing 64 linear, liquid, energy, and miscellaneous factors on one side, and a complete trigonometric scale arrangement on the reverse side consisting of A, K, DF-CF, T, S, CI, C-D, and L scales. By merely "positioning" a conversion mark opposite an index mark, any conversion is automatically set and read on the C, D, CF, or DF scales without moving the slider or further computation. The same automatic conversion principle is adaptable to any set of specialized conversion factors on either pocket-size or 10-in. rules for any type of work.

The National Academy of Sciences-National Research Council has announced **new memberships in the Building Research Institute**, a branch of the Division of Engineering and Industrial Research. They are Aluminum Co. of America, Pittsburgh; Baldwin Hill Co., Trenton; E. K. Geyser Co., Pittsburgh; Independent Nail and Packing Co., Bridgewater, Mass.; Industrial Sound Control, Inc., Hartford, Conn.; Inland Home Corp., Piqua, Ohio; Minneapolis-Honeywell

Regulator Co., Minneapolis; Unistrut Corp., Wayne, Mich.; Virginia Metal Products, Inc., Orange, Va.; A. M. Byers Co., Pittsburgh. New associate members are Douglas E. Parsons, chief of the building technology division, National Bureau of Standards; and E. George Stern, research professor and head of the department of wood construction, Virginia Polytechnic Institute.

The Building Research Institute is a technical organization for research-minded men from the professions and businesses of the building industry. It holds conferences and sponsors, but does not perform, research. It publishes the proceedings of its conferences, a newsletter, and reviews and abstracts of publications about building research.

A method for choosing a solvent system to use for **countercurrent distribution** is described by C. A. Hollingsworth, J. J. Taber, and B. F. Daubert in a paper soon to appear in *Science*. The separation of two solutes by countercurrent distribution depends upon the fact that the two solutes are distributed differently between two immiscible solvents. Workers often add a third solvent to the immiscible pair of solvents in order to obtain partition coefficients that will yield satisfactory separations. Hollingsworth *et al.* have developed a systematic method for arriving at the proper composition of the three-solvent system. The application of their method requires simply the determination of the critical point of the three-solvent system and partition coefficient values at one or two compositions not too far from the critical point.

George Bartholomew and William Dawson of the University of California at Los Angeles report that the **mourning dove** can go four or five days without water or succulent food in moderate temperatures and suffer no ill effects. It is able to drink in 10 min an amount of water equivalent to over 17 percent of its body weight.

Enough toxins to cause **food poisoning** may develop at a temperature of 100°F in 4 to 5 hr, warns Oliver W. Kaufmann, department of food technology, University of Illinois. One bacterium kept at body temperature for 24 hr can multiply 5×10^9 times. By contrast, a bacterium kept at 50°F multiplies only 500 times.

A **nova** was discovered in the constellation Ophiuchus on 21 July by Victor Blanco of the Warner-Swasey Observatory, Cleveland. Visible low on the southern horizon in the early evening hours, its magnitude is now about 9; hence it can be seen with a small telescope. Its location is 17 hr, 20.8 min in right ascension, minus 27 deg, 39 sec in declination.

A **tooth drill** that also has industrial possibilities has been invented by R. J. Nelson, C. E. Pelander, and J. W. Kumpula at the National Bureau of Standards. It has a tiny turbine, driven by water, that spins at a rate of 61,000 rev/min. Its diamond-disk grinding point

stops instantly when a finger is abruptly placed against its edge, if the dentist presses too hard while grinding a tooth, or if the tool should happen to catch or bind in a manner that would be hazardous. It does not climb or roll out of the cavity.

Water is pumped to the driving turbine through a flexible tube and, after passing through the turbine, returns to the pump in another tube that jackets the inflow tube. The dentist can stop the drill for a moment by stepping on a special tube filled with fluid; the fluid trips a pressure-sensitive switch which shunts the water around the turbine. The tool could be of industrial use where small bits of hard materials must be ground away, as in tool and die making.

The secret wartime development of DDT as an insecticide to protect our armed forces is the subject of a sprightly written story by Robert Rice in the *New Yorker* magazine for 17 July. The story also describes the lasting qualities of DDT, which have convinced "a number of jittery souls that mankind has finally and inexorably embarked on a course of suicide by slow poison."

The American Hospital Supply Corp., Evanston, Ill., has announced a fast, new blood typing procedure. A Haematotype Card is coated with Dade serums which make it possible to determine blood grouping and Rh typing right on the card itself. No preparation or complicated procedures are involved. In tests conducted in hospital laboratories and blood banks throughout the country, the cards have consistently proved 100-percent accurate in blood-grouping determinations and as high as 98-percent accurate in Rh typing.

Scientists in the News

A recent appointment to head the microbiology program and become assistant professor of botany at Dartmouth College is **Raymond W. Barratt**. Previously he was at Stanford University. **Wilbur T. Ebersold**, Public Health Service research fellow of the National Cancer Institute, also has joined the Dartmouth staff.

Lyle Borst, who has been on the faculty of the University of Utah since 1951, has been made chairman of the department of physics at New York University's College of Engineering. He succeeds **Yardley Beers** who has been serving as acting chairman and will continue on the faculty.

Richard A. Carrigan, supervisor of analytical chemistry at Armour Research Foundation of the Illinois Institute of Technology, left in July for Burma to work on a project to reorganize and expand the State Industrial Research Institute in Rangoon. Purpose of the project is to strengthen Burma's research and development activity by improving the facilities of the institute. Dr. Carrigan will aid **Christopher Barthel, Jr.**, resident director of the Rangoon institute, in setting

up laboratories in spectroscopy and analytical chemistry and in training personnel.

Hans Ludwig Hamburger of the University of Cologne will be a visiting professor in the Cornell mathematics department during the coming academic year. Professor Hamburger, whose fields are mathematical analysis, differential geometry, and the theory of linear transformations, will conduct the undergraduate honors seminar in mathematics and also an advanced seminar in analysis. He taught at the University of Cologne from 1924 to 1935, and returned there a year ago. From 1941 to 1947 he was on the faculty of the University College of Southampton and from 1947 to 1953 at the University of Ankara, Turkey.

James G. Horsfall, director of the Connecticut Agricultural Experiment Station, will give the main address at the station's annual field day 18 Aug. at Mt. Carmel. In keeping with this year's field-day theme, which emphasizes research on plant diseases, his topic is "The rots and the rusts, the blasts and the blights that beset us."

Charles E. Kellogg, assistant administrator for soil survey, Soil Conservation Service, U.S. Department of Agriculture, will attend the Fifth International Congress of Soil Science, to be held in Leopoldville, Belgian Congo, 16 to 23 Aug., where he will deliver one of the six major addresses. Enroute, he will spend a short time in study of the soil investigations on the Gold Coast, at the request of the British Government. He also plans to visit soil research institutions in several European countries on his way home.

A. Packchanian, professor of bacteriology and parasitology and director of the Laboratory of Microbiology at the University of Texas School of Medicine, Galveston, has gone to Africa to study the chemotherapy of African sleeping sickness, for which he has discovered three new and specific drugs. The bulk of his investigation will be conducted in the Belgian Congo, Nigeria, and Uganda. On his return trip, in late September, he will stop briefly in Egypt to study amebiasis, in Arabia to collect data on yaws, and in Iran and Lebanon to make a brief survey of leishmaniasis.

Alex Reed, associate professor of agriculture at Southern Illinois University, Carbondale, has accepted an invitation to serve for 2 yr as associate professor in dairy science at the Allahabad Agricultural Institute in India.

On 14 July the College of Physicians of Philadelphia awarded the Alvarenga prize for 1954 to **DeWitt Stetten, Jr.**, associate director in charge of research, National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Bethesda, Md. The prize was established by the will of Pedro Francisco Da Costa Alvarenga of Lisbon to be awarded annually on the anniversary of the death of the testator.

John C. Ullery has been named professor and chairman of the department of obstetrics and gynecology in Ohio State University's College of Medicine, effective 1 Oct. Dr. Ullery, who has been assistant professor of obstetrics and gynecology at Jefferson Medical School since 1950, will succeed **Allan C. Barnes**, who resigned in 1953. Acting chairman since that time has been **Z. J. R. Hollenbeck** of the department.

J. M. Dalla Valle, professor of chemical engineering at Georgia Institute of Technology, and **B. C. Moore**, department of mathematics at A. & M. College of Texas, have joined the technical service division of Humble Oil & Refining Co.'s Baytown, Texas, refinery for the summer. Dr. Dalla Valle was a Fulbright lecturer at the universities of Milan and Nottingham last year.

The Office of International Relations, National Academy of Sciences-National Research Council, has provided the following information concerning the travel plans of scientific visitors to the United States and Canada.

Henry Barcroft, Sherrington School of Physiology, St. Thomas's Hospital, London. Here from late November to mid-December to attend the Fourth Conference on Shock and Circulatory Homeostasis at Princeton, N.J.

R. P. Bell, fellow of Balliol College, Oxford, and demonstrator in chemistry in the University of Oxford. Here 7 Sept. to 27 Oct. to attend a conference on reaction mechanism and an American Chemical Society symposium, and to visit Northwestern University.

A. C. Hulme, Ditton Laboratory, Department of Scientific and Industrial Research, East Malling, Kent. Beginning in the fall, will be here 1 yr to carry out research on the metabolism of amino acids and proteins in fruit at Cornell University.

W. J. Robinson, head of Fluid Mechanics Division of Mechanical Engineering Research Laboratory, DSIR, London. Here from 31 Aug. to about 25 Sept. to attend the International Electrotechnical Commission committee meeting on hydraulic turbines in Philadelphia. Various other visits in U.S. and Canada.

Niko Tinbergen, department of zoology and comparative anatomy, University Museum, Oxford University. Here 22 Sept. to 10 Oct. to attend the First Conference on Group Processes in Ithaca, New York.

N. Booth, general manager, research and development department, The British Oxygen Co. Ltd., London, coming in the fall to discuss low temperature research, use of oxygen in metallurgical processes, and acetylene chemicals.

R. S. Dadson, physics division, National Physical Laboratory, DSIR, London. Here 2 Sept. to about 15 Oct. as a delegate to the International Electrotechnical Commission. Various other visits.

A. Fitton, P.S.O., Fuel Research Station, DSIR, London. Here in August and in the fall to attend a conference on "Vehicle combustion products and other emissions" at Pasadena, Calif.

J. A. Hall, physics division, National Physical Laboratory, DSIR, London. Here 15 Oct. to 6 Nov. to attend the "Third symposium on temperature" in Washington, D.C.

Sarangapani Parthasarathy, New Delhi, India., head of the division of sound, National Physical Laboratory, New Delhi. Will come sometime in 1954 for 90 days. Schedule to be arranged by the American Council on Education.

Meetings

A program of 23 papers has been arranged for the symposium, "Problems relating to the physical adsorption of gases and solids," to be sponsored by the physical chemistry division of the Chemical Institute of Canada at the Royal Military College, Kingston, Ont., 10-11 Sept. Eric Rideal of King's College, London, will be a guest. Speakers from industrial, university, and government research organizations in the United States and Canada will attend. For details write W. G. Schneider, Division of Pure Chemistry, National Research Council, Ottawa, Ont.

The Institute of Radio Engineers' Professional Group on Industrial Electronics and the Pittsburgh Section of IRE are cosponsoring a symposium to be held in the Mellon Institute, Pittsburgh, 29-30 Sept. It is designed to be of interest to those in industry who are finding that electronics is playing an increasing role in their field. The four sections deal with gauging and process control, applications of light, high-power electronics, and automation and control. For registration information write to J. B. Woodford, Jr., Carnegie Institute of Technology, Pittsburgh 13.

The fall assembly meeting of the Radio Technical Commission for Aeronautics will be held at the Willard Hotel in Washington, D.C., 30 Sept. to 1 Oct. The first day of the meeting will be devoted to a review of RTCA activities. On the second day a study will be made of the current status of the "Common system" of air navigation, communication, and traffic control. The functions and work of various Government agencies in the development and implementation of the system will be explored in detail.

The International Committee on Monuments, set up by UNESCO in 1950 to advise on the conservation, protection, and restoration of monuments, artistic and historical sites, and archeological excavations, has prepared recommendations with regard to international regulations for archeological excavations. The object of such measures is to secure every possible access by archeologists of all countries to archeological sites and insure international cooperation in this field. These recommendations will be submitted for approval to the General Conference of UNESCO in Montevideo, Uruguay, 12 Nov.-11 Dec.

Six symposiums of technical papers and two discussion programs have been scheduled for the 14-15 Oct.

meeting in Dallas of **South Central Region, National Association of Corrosion Engineers**. Papers will be presented on cathodic protection, protective coatings, inhibitors, processing plant corrosion problems, pipeline corrosion, and oil and gas production. R. C. Buchan, Humble Oil and Refining Co., Houston, is technical program chairman and Sam Hodgdon, Metal Goods Corp., Dallas, is general chairman.

An international meeting on **Technique of Ships and Navigation** will take place from 26 Sept. to 1 Oct. in Naples. The five sections will deal with "Naval architecture," "Ship construction," "Internal combustion engines and steam propelling apparatus," "Electric plants and equipment," and "Sea and air navigation." Applications may be obtained from Segreteria Mostra d'Oltremare, Naples, Campi Flegrei, before Aug. 15.

Education

Physicians, nurses, and medical students participated in the 4th course in tropical public health held in Mexico under the supervision of Harold Mozar, Director of the School of Tropical and Preventive Medicine of the College of Medical Evangelists. The purpose of this 3-wk course is to give insight into living conditions and medical practice in the tropics and an understanding of socio-economic implications of health and disease in an underdeveloped area. In addition to supervised visits to hospitals, clinics, and villages for clinical demonstrations, environmental sanitation was studied under actual field conditions.

More than \$1 million in contributions by American physicians during 1953 have been turned over to the National Fund for Medical Education to ease the financial plight of the nation's medical schools. E. L. Turner, Chicago, secretary-treasurer of the American Medical Education Foundation, said "the contributions sent in by doctors throughout the nation is an example of outstanding service in aiding humanity through medicine."

Lewis F. Hatch of the University of Texas is directing an industrial short course on petrochemicals 2 to 14 Aug. in Bartlesville, Okla. Dr. Hatch will present latest information on basic chemical reactions involved when petroleum raw materials are used in the manufacture of chemical products. Phillips Petroleum Co. is sponsoring the short course.

The first of four 5-day courses to be given by the Army Medical Service during the present fiscal year on "The medical care of atomic casualties" will begin 24 Aug. at the Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington, D.C. The other three courses will be given 25-30 Oct., 10-15 Jan., and 7-12 Mar.

The courses are open to active duty professional officers of the component corps of the Army Medical Service and to medical service professional personnel

of the Air Force, Navy, Public Health Service, Veterans Administration, and Civil Defense. Army Medical Service personnel should apply to the Office of the Surgeon General, Attention: Personnel Division, Career Management Branch. All others should direct their applications through their proper command or administrative channels.

A chair in mechanical engineering has been established at Stevens Institute of Technology in the name of George Meade Bond, whose development of accurate standards of measurement has been credited with making modern mass production methods possible. The chair is endowed under a bequest of more than \$300,000 from the late Mrs. Ella Kittredge Gilson of Hartford, Conn.

A series of 80 new workshop designs of laboratory apparatus for schools was published in July by UNESCO. They are precise engineering drawings for use in the manufacture of the essential apparatus and instruments for the teaching of physics, chemistry, and biology in schools and universities. They also will be useful in the shops of the many small-production industries that are now being set up in under-developed countries. The drawings contain no words, but each is accompanied by a separate sheet bearing exact specifications for the purchase of materials, and detailed instructions. Suggestions for its use are given in English and French with space for translation into any language. They are available through UNESCO publication distributors in the member states.

Grants, Fellowships, and Awards

Applications for awards available 1 July 1955 will be received by the **Life Insurance Medical Research Fund** as follows: (i) Postdoctoral research fellowships, until 29 Oct., 1954; preference is given to those who wish to work on cardiovascular function and disease or related fundamental problems; minimum stipend \$3500, with allowances for dependents and necessary travel. (ii) Grants to institutions in aid of research on cardiovascular problems, until 15 Nov. 1954; support is available for physiological, biochemical, and other basic work broadly related to cardiovascular problems as well as for clinical research in this field. Application forms may be obtained from the Scientific Director, Life Insurance Medical Research Fund, 345 East 46 St., New York 17.

A Presidential Citation was awarded in July to the University of California's Los Alamos Scientific Laboratory for its outstanding achievements in the research and development of the nation's nuclear and thermonuclear weapons. The citation was presented for President Eisenhower by Lewis L. Strauss, chairman of the Atomic Energy Commission, to Norris E. Bradbury, director of the laboratory, and members of its technical board.

The National Jewish Hospital at Denver has announced the creation of two research fellowships: the Walter P. Harris fellowship in clinical research and the A. T. Hirsh fellowship in cardio-pulmonary physiology. The former, for studies in the field of tuberculosis and chest diseases, will have a tenure of 2-3 yr and provides a yearly stipend not to exceed \$7500. The latter is a \$6000, 1-yr fellowship. Address applications to Gardner Middlebrook, Director of Research and Laboratories, National Jewish Hospital, Denver.

The National Science Foundation has announced 176 grants totaling about \$1,120,000 for the support of basic research in the natural sciences, studies and conferences on science, scientific information exchange, scientific manpower, education in the sciences, and travel of American scientists to international scientific meetings. This is the fourth and final group of awards to be made during fiscal year 1954 by the Foundation for the support of basic research and related matters.

University of Chicago. G. van Biesbroeck, Yerkes Observatory. Astrometric observations, 1 yr, \$4400.

University of Illinois. G. C. McVittie, astronomy. Classical and relativistic gas dynamics by the method of Einstein's equations, 2 yr, \$11,400.

Indiana University. F. K. Edmondson, astronomy. Observations of asteroids, 1 yr, \$5000.

Ohio State University. A. Slettebak, physics and astronomy. Line broadening in early-type supergiant stars, 1 yr, \$2700.

University of Virginia. A. N. Vyssotsky, astronomy. Spectra of faint stars, 1 yr, \$3500.

University of California. T. L. Allen, chemistry. Dissociation equilibria of metallic halides at high temperatures, 3 yr, \$6000.

University of Southern California. W. K. Wilmarth, chemistry. Aromatic free radicals, 2 yr, \$6300.

Monmouth College. G. W. Thiesen, chemistry. Benzenoid inhibition of the Kolbe electrolysis, 1 yr, \$5000.

Mount Holyoke College. L. W. Pickett, chemistry. Vacuum ultraviolet spectra of selected organic compounds, 2 yr, \$11,000.

University of Mississippi. W. L. Nobles, School of Pharmacy. Studies involving the Mannich reaction, 2 yr, \$4100.

Reed College. A. F. Scott, chemistry. Chemical determination of atomic weights, 2 yr, \$8000.

Tufts College. C. E. Messer, chemistry. Solid solution formation and solid-liquid phase equilibria in systems of aromatic ring compounds, 1 yr, \$5000.

University of Washington. W. M. Schubert, chemistry. Aromatic electrophilic substitution by hydrogen, 3 yr, \$6500.

Atlanta University. M. L. Reddick, biology. Pattern of outgrowth of cells from chick medulla grown *in vitro*, 2 yr, \$4600.

University of Colorado. H. Herrmann, pediatrics, School of Medicine. Embryonic development and maturation of muscle tissue, 1 yr, \$7500.

Gralanell College. G. Mendoza, biology. Yolk nucleus of the teleost ova, 1 yr, \$500.

Rice Institute. R. V. Talmadge, biology. Hormonal basis for implantation of blastocyst in armadillo, 2 yr, \$13,000.

St. Ambrose College. W. F. Lynch, biology. Factors inducing metamorphosis in *Bugula*, 1 yr, \$450.

University of Washington. W. S. Hsu, zoology. Bdelloid ectology, 2 yr, \$3200.

University of Alaska. C. T. Elvey, Geophysical Institute. Ionospheric research using both radio waves of extra terrestrial origin and from controlled transmitters, 2 yr, \$20,000.

University of California. C. A. Nelson, geology. Cambrian strata of the Inyo Mountains, Calif., 3 yr, \$8600.

Paleontological Research Institution. J. D. McLean, Jr. Foraminifera of the Yorktown formation, 1 yr, \$5200.

Pennsylvania State University. M. L. Keith, earth sciences. Fractionation of stable isotopes in geologic processes, 2 yr, \$15,100.

Pennsylvania State University. O. F. Tuttle, earth sciences. Stability relations of silicate-carbonates at elevated temperatures and pressures, 1 yr, \$5500.

Wayne University. W. H. Parsons, geology. Problems of igneous geology in the Beartooth Mountain area, Wyoming-Montana, 1 yr, \$3700.

University of Arizona. T. L. Martin, Jr., and C. R. Hausenauer, electrical engineering. Thermionic ion generation in contaminated air and other gases, 2 yr, \$10,000.

University of Delaware. A. B. Metzner, chemical engineering. Engineering reaction kinetics of ethylene oxide hydration, 18 mo, \$9000.

University of Detroit. R. H. McCormack, chemical engineering. Solubility of hydrogen chloride and ammonia in water and organic solvents, 18 mo, \$2300.

Mississippi State College. D. M. McCain, civil engineering. Stress-strain relations in plain concrete under simulated beam action, 1 yr, \$5500.

Oregon State College. J. G. Knudsen, chemical engineering. Heat transfer coefficients in baffled tubular heat exchanges, 2 yr, \$7200.

University of Pennsylvania. F. F. Hagerty, chemical engineering. Fixed bed problem with a nonlinear equilibrium relationship, 1 yr, \$5000.

Rensselaer Polytechnic Institute. J. O. Hougen, chemical engineering. Reduction of metallic oxides with hydrogen, 1 yr, \$4300.

University of Wisconsin. J. A. Duffie, Engineering Experiment Station. Solar energy research, 3 yr, \$13,000.

Emory University. F. H. Bormann, biology. Ecology of southern pine, 2 yr, \$4200.

University of Miami. H. B. Moore, Marine Laboratory. Reactions of the copepods of the Florida current, 2 yr, \$11,600.

Stanford University. D. P. Abbott and R. L. Bolin, Hopkins Marine Station. Populations of marine organisms, 1 yr, \$7100.

University of Detroit. P. F. Forstoechel, zoology. Developmental genetics of *Lixoides*, a new skeletal variation in the house mouse, 2 yr, \$7900.

Radford College. V. L. House, biology. Genetic control of variation in *Drosophila*, 2 yr, \$7500.

Smith College. A. F. Blakeslee, Genetics Experiment Station. Evolution and life processes in plants, 2 yr, \$14,000.

Alabama Polytechnic Institute. H. Wang. Subgroups of complex lie groups and groups of holomorphic homeomorphisms, 1 yr, \$8900.

Columbia University. E. R. Lorch, mathematics. Volume in Hilbert space, 1 yr, \$5700.

Institute for Advanced Study. S. Chern, mathematics. Pseudo groups with emphasis on complex and symplectic manifolds, 1 yr, \$8450.

University of Michigan. W. Kaplan, mathematics. Problems in the theory of functions of a complex variable, 6 mo, \$1600.

Ohio State University. M. Hall, Jr., mathematics. Combinatorial problems, 18 mo, \$10,400.

Pennsylvania State University. H. B. Curry, mathematics. Combinatory logic, 1 yr, \$9400.

University of California. G. Mackinney, food technology. Carotenoid biosynthesis, 2 yr, \$16,000.

Johns Hopkins University. W. L. Hughes, McCollum Pratt Institute. Nature of the heme-globin linkage, 3 yr, \$18,000.

University of Michigan. A. G. Norman, botany. Interrelationships between plant cell wall polysaccharides, 2 yr, \$16,000.

University of Nebraska. J. N. Pazur, Agricultural Experiment Station. Enzymatic synthesis of glucosyl carbohydrates, 2 yr, \$10,500.

Woods Hole Oceanographic Institution. F. A. Richards. Significance of chlorophyll C, 2 yr, \$8000.

Bowdoin College. M. A. Jeppesen, physics. Optical studies of surface and body properties of crystalline and amorphous solids, 2 yr, \$14,100.

Rensselaer Polytechnic Institute. P. J. Bray, physics. Molecular and crystalline structure by a nuclear resonance absorption technique, 2 yr, \$17,200.

University of Virginia. J. W. Beams, physics. Ultracentrifuge research on molecular weights, 2 yr, \$9800.

Wisconsin Alumni Research Foundation. R. Rollefson, physics. High-energy accelerators, 3 mo, \$31,500.

Boston University. J. M. Harrison, psychology. Relation between the hippocampus and sensory hyperesthesia, 2 yr, \$9400.

University of Southern California. W. W. Grings, psychology. Stimulus patterning in learning, 3 yr, \$9400.

Florida State University. W. N. Kellogg, Oceanographic Institute. Echolocation in the dolphin, 1 yr, \$7000.

George Washington University. B. H. Fox, psychology. Vision, 1 yr, \$5900.

Johns Hopkins University. E. F. MacNichol, Jr., biophysics. Visual research, 3 yr, \$9800.

Northwestern University. A. L. Diamond, psychology. Psy-

- cho-physiology of vision: simultaneous brightness contrast, 2 yr, \$9000.
- University of Utah. P. B. Porter, psychology. Psychological effects of antimetabolites, 2 yr, \$10,000.
- Rutgers University. D. S. Lehrman, psychology. Physiological basis of incubation behavior in the ring dove, 2 yr, \$9500.
- University of Wisconsin. W. J. Brodgen, psychology. Verbal factors in the learning of motor skill, 3 yr, \$15,100.
- University of Wisconsin. K. U. Smith, psychology. Role of perception in patterned motion, 2 yr, \$7800.
- Yale University. F. A. Logan, psychology. Conditions of reinforcement, 1 yr, \$5200.
- Yale University. K. C. Montgomery, psychology. Exploration and fear behavior in lower animals, 2 yr, \$11,400.
- Columbia University. A. Gorbman, zoology. Comparative physiology of thyroïdal function, 2 yr, \$1,3300.
- Emory University. F. W. Fales, biochemistry. Alkali-insoluble reserve carbohydrate of yeast cells, 2 yr, \$9100.
- Indiana University. W. J. van Wagendond, zoology. Role of steroids in the metabolism of *Paramecium aurelia*, 2 yr, \$14,000.
- Jefferson Medical College. B. W. Koff, bacteriology. Growth factor to replace P-aminobenzoic and folic acids, 2 yr, \$5100.
- Kaiser Foundation. E. C. Dougherty, internal medicine. Nutrition of free-living nematodes, 2 yr, \$13,400.
- Massachusetts General Hospital. A. Leaf, medicine. Mode of action of the antidiuretic hormone, 1 yr, \$1000.
- Princeton University. W. P. Jacobs, biology. Internal factors limiting differentiation of plant cells, 3 yr, \$15,400.
- St. John's University. D. M. Lilly, biology. Nutritional factors in growth of carnivorous protozoa, 2 yr, \$7600.
- University of Tennessee. D. F. Holtzman, bacteriology. Role of amino acids in the host-parasite relationship, 2 yr, \$8300.
- Wabash College. W. H. Johnson, biology. Nutritive requirements of *Paramecium multimicronucleatum*, 2 yr, \$3000.
- Yale University. G. E. Pickford, Bingham Oceanographic Laboratory. Pituitary hormones of fish, 3 yr, \$14,400.
- F. Harper, Mt. Holly, N.J. Flora and fauna of the central Labrador peninsula, 2 yr, \$10,300.
- University of Florida. J. C. Dickinson, Jr., biology. Biological survey of Flint-Chattahoochee-Appalachicola drainage basins, 3 yr, \$5200.
- University of Idaho. H. A. Imshang, biological sciences. Alpine lichens of western America, 2 yr, \$8500.
- University of Minnesota. J. W. Hall, botany. Coal ball floras, 2 yr, \$2600.
- College of New Rochelle. M. D. Rogick, biology. Bryozoa of the Antarctic, 2 yr, \$3900.
- State University of New York. J. L. Lowe, College of Forestry. Polyporaceae of North America, 1 yr, \$1200.
- Roosevelt College. C. H. Seavers, biology. Systematics and evolution of Staphylinidae, 3 yr, \$8400.
- Tulane University. G. H. Penn, zoology. Speciation in crawfish, 2 yr, \$5200.
- State College of Washington. G. W. Fischer, plant pathology. Revision of the genus *Tilletia*, 2 yr, \$6500.
- University of Wisconsin. E. V. Morse, veterinary science, and E. McCoy, bacteriology. Speciation of animal pathogens of the genus *Vibrio*, 2 yr, \$9550.
- Yale University. S. D. Ripley, Peabody Museum of Natural History. Speciation in bird fauna of the eastern Moluccan Islands, 1 yr, \$1700.
- University of Chicago. R. J. Braidwood, anthropology. Human population studies in the fertile crescent, 3 yr, \$23,500.
- Harvard University. P. Doty, chemistry. Physicochemical properties and characterization of polymer molecules, 3 yr, \$16,000.
- University of Illinois. L. M. Black, botany. Isolation and characterization of plant viruses, 3 yr, \$5500.
- Washington University. Summer research by medical students, 3 yr, \$6900.
- Attendance at international meetings*
- Eleventh General Assembly of International Scientific Radio Union and International Congress of Mathematicians. W. Magnus, Institute of Mathematical Sciences, New York, N.Y., \$500.
- Eleventh General Assembly of International Scientific Radio Union. M. G. Morgan, Thayer School of Engineering, Dartmouth College, \$200.
- International Congress of Mathematicians. G. S. S. Ludford, mathematics and Institute for Fluid Dynamics, University of Maryland; E. Hewitt, mathematics, University of Washington, \$1000.
- International Congress for Philosophy of Science. H. Feigl, Minnesota Center for Philosophy of Science, University of Minnesota; H. Margenau, physics, Yale University, \$1200.
- International Symposium on Infrared. S. S. Ballard, Santa Monica, Calif., \$700.
- Eighth General Assembly of International Union of Pure and Applied Physics. K. K. Darrow, Bell Telephone Laboratories, \$600.
- Tenth General Assembly of International Union of Geodetics and Geophysics. J. Bjerknes, meteorology, University of California; H. F. Blaney, Soil Conservation Service, USDA; R. R. Heinrich, geophysics and geophysical engineering, St. Louis University; W. D. Lambert, Canaan, Conn.; M. O. Schmidt, civil engineering, University of Illinois; W. E. Smith, American Geophysical Union of the National Research Council; H. G. Wilm, College of Forestry, State University of New York, \$5100.
- Third International Gerontological Congress. J. E. Birren, National Institutes of Health; A. J. Carlson, physiology, University of Chicago; O. J. Kaplan, psychology, San Diego State College; A. H. Norris, Baltimore City Hospital, \$1940.
- Eighth International Congress of Botany, International Union of Biological Sciences. E. Ball, botany, North Carolina State College; R. M. Blouch, botany and plant physiology, Colorado A. and M. College; J. E. Canright, botany, Indiana University; E. C. Cantino, botany, University of Pennsylvania; L. C. Cochran, USDA, University of California; A. L. Cohen, biology, Oglethorpe University; H. B. Creighton, botany, Wellesley College; A. R. Cross, geology, West Virginia University; J. D. Dwyer, biology, St. Louis University; J. E. Gunckel, botany, Rutgers University; J. H. M. Henderson, biology, Tuskegee Institute; A. S. Holt, botany, University of Illinois; V. H. Jones, University Museum, University of Michigan; P. J. Kramer, botany, Duke University; S. L. Meyer, botany, Florida State University; L. S. Olive, botany, Columbia University; E. A. Phillips, botany, Pomona College; P. C. Silva, botany, University of Illinois; R. H. Thompson, botany, University of Kansas; R. M. Tryon, Jr., Herbarium, Missouri Botanical Garden, \$8965.
- International Astronomical Conference. D. Brouwer, Yale University Observatory; J. J. Nassau, Warner-Swasey Observatory, \$1800.
- Eighth Congress of International Society for Cell Biology. J. J. Bielecki, Sloan-Kettering Institute for Cancer Research; J. D. Ebert, zoology, Indiana University; C. Grobstein, National Cancer Institute; M. R. Murray, Columbia University; I. I. Oster, Institute of Animal Genetics, Edinburgh; C. M. Pomerat, University of Texas; H. Ria, zoology, University of Wisconsin; A. M. Schechtman, zoology, University of California, \$8500.
- Eleventh International Ornithological Congress. R. W. Storer, University of Michigan; C. Vaurie, American Museum of Natural History; C. G. Sibley, dept. of conservation, Cornell University; G. H. Lowery, Jr., zoology, Louisiana State University, \$1600.
- Third Meeting of Joint Commission of Spectroscopy of the International Council of Scientific Unions. R. S. Mulliken, physics, University of Chicago, \$500.
- Conference on Experimental and Theoretical Nuclear Physics. M. Gell-Mann, Institute for Nuclear Studies, University of Chicago; A. C. Helmholz, physics, University of California; C. Wu, physics, Columbia University, \$1500.
- Conferences in support of science*
- University of California. Anomalous magnetization of rocks, \$7400.
- Columbia University. Crust of the earth, \$6000.
- Cornell University. Fundamental problems of perception, \$4500.
- Harvard University. Problems in comparative behavior, \$6300.
- University of Kansas. Genetic, psychological, and hormonal factors in the regulation of patterns of sexual behavior in mammals, \$5000.
- Massachusetts Institute of Technology. Problems in human communication and control, \$5200; mathematical tables, \$4700.
- National Academy of Sciences. Radiation biochemistry, \$3100.
- Society for Study of Development and Growth. Thirteenth Symposium on Development and Growth, \$1500.
- Education in the sciences*
- City College, New York. Preliminary survey of the teaching of biochemistry, \$500.
- National Academy of Sciences. Committee on Educational Policies in the Division of Biology and Agriculture of the National Research Council, \$1725.
- National Association of Biology Teachers. Southeast Conference on Training in Biology, \$15,000.

Northwestern University. Training of laboratory assistants in physics, \$2200.

Studies in science

Battelle Memorial Institute. Study of research activities of trade associations, cooperative industrial research organizations, and industry-supported research activities of professional societies and associations, \$42,331.

Roger Williams Technical and Economic Services, Inc. Pilot study of industry-government relationships in research by survey of present status of basic and applied research bearing on industrial fermentation processes, \$15,000.

Syracuse University. Survey of past history and present status of research activities of independent and quasi-independent nonprofit research institutes and of commercial laboratories, \$32,000.

Scientific information exchange

American Institute of Physics. Study of a comprehensive Russian-English translating service in the fields of physics, \$3300.

University of California. Preparation of a punched card file of double star measures, \$15,500.

University of Hawaii. Exchange of biological research information at the Hawaii Marine Laboratory, \$6000.

Library of Congress. Compilation of lists of current biological periodicals, \$8800.

Marine Biological Laboratory, Woods Hole, Mass. Participation in the exchange of scientific information at the laboratory, \$1800.

National Academy of Sciences. Preparation of a monograph on the training of scientists and engineers in Russia, \$1900.

Documentation, Inc. Semimechanized system for indexing and retrieving scientific information, \$8000.

Wayne University. Support of *Human Biology*, \$3250.

Scientific manpower

American Chemical Society. Register of scientific and technical personnel in the field of chemistry, \$69,000.

Engineers Joint Council. Register of scientific and technical personnel in engineering, \$25,000.

National Academy of Sciences. Register of scientific and technical personnel in the earth sciences, \$5500.

University of Minnesota. Loss of talent through educational drop-out at high school graduation: a follow-up study of talented high school graduates who did not attend college, \$8250.

Miscellaneous

Applications for active duty in the Army Dental Corps are being invited for the first time since September of last year from holders of reserve commissions as well as dentists having no military affiliation, regardless of priority classification. If recruitment is successful, it may postpone indefinitely a further Army draft call.

The East Bay Chapter of the American Institute of Architects, Oakland, Calif., in connection with the Alameda County Heart Association, is engaged in a research program to improve the environment of the cardiac at home and at work. Anyone who has information, purely practical as well as technical, that might be of help in the study should write to J. H. Ostwald, Director of Research, Alameda County Heart Association, 121 E. Eleventh St., Oakland 12.

The following chemicals are wanted by the Registry of Rare Chemicals, Armour Research Foundation of Illinois Institute of Technology, 35 W. 33 St., Chicago 16: zinc hydride; titanium trifluoride; sodium teluride; phosphonium iodide; molybdenum carbonyl; 3-methyl-1,6-hexandiol; dimethylmaleic anhydride;

6,7-dihydroxycoumaran; ethyl alpha-methylacetooacetate; omega-chloro-2,3,4-trihydroxyacetophenone; 2,4-dichlorophenylsulfoneacetic acid; gentisic aldehyde; 3-methyl-2-naphthoic acid; 1,2,4,5-tetrahydroxybenzene; 6-hydroxynicotinamide; melibionic acid; creatininease; tigonin; sedo-heptulose; carbonic anhydrase.

An atlas dealing with the climate of Canada has just been released jointly by the Meteorological Division, Federal Department of Transport, and the Division of Building Research, National Research Council of Canada. Included are 84 maps of Canada, each of which provides information about an important aspect of the weather elements. The atlas also contains diagrams called hythergraphs, which show the average climate through the year for many locations, including London, Paris, and Washington, D.C. The atlas may be obtained for \$2 from the National Research Council, Ottawa 2.

The U.S. Civil Service Commission announces an examination for the filling of patent adviser positions in radio and electronics in the Signal Corps Center and Fort Monmouth, N.J. Applications will be accepted until further notice and must be filed with the Board of Civil Service Examiners, Headquarters, Signal Corps Center and Fort Monmouth, N.J.

Effective immediately, all publications intended for review in *Philosophy of Science*, a quarterly published by the Philosophy of Science Association, should be sent to the book review editor, J. Sayer Minas, Dept. of Philosophy, The Ohio State University, Columbus 10.

The *Proceedings of the University Research Reactor Conference*, held at Oak Ridge last February, is available for \$1.35 from the Office of Technical Services, Department of Commerce, Washington 25, D.C.

The Fels Planetarium of Franklin Institute will again take visitors on a round trip to Saturn. Visual and audio techniques are employed to create the illusion of travel. This presentation will run during August and through 12 Sept. at 3 every afternoon except Monday, with extra shows on weekends. Evening demonstrations are at 8:30 Wednesday, Friday, and Saturday.

First issue of *Scienza Nuova*, an international quarterly of reviews and abstracts of studies in the psychosociological and humanistic sciences has appeared. It is published by the Linecombe Lodge Research Library, Boars Hill, Oxford.

Lange, Maxwell & Springer Ltd., English booksellers, have started a project to translate Soviet scientific, technical, and medical books into English. The first list of titles includes books on astronomy, chemistry, mathematics, medicine, meteorology, physics, and physiology.

Book Reviews

Soft Magnetic Materials for Telecommunications.

C. E. Richards and A. C. Lynch, Eds. Interscience, New York; Pergamon, London, 1953. 346 pp. Illus. + plates. \$9.

This book is a collection of 35 papers presented at a 3-day conference at the Post Office Engineering Research Station at Dollis Hill, London, in Apr. 1952. The contributors are from England and the Continent, about an equal number from universities, government, and industrial research laboratories. The papers vary widely in scope and are devoted to theoretical discussions of the basic processes of magnetization, investigations to explain observed magnetic phenomena, and descriptions of new commercial materials and processes. The papers do not go so far as to discuss in any detail the atomic structure or atomic moments of magnetic substances.

The conference was organized by the editors of the book, who are to be congratulated on their initiative and on the successful completion of their plan. One recalls the symposia on magnetism held in England by the Institution of Electrical Engineers in Nov. 1949 and by the Physical Society many years earlier, in 1930. It is gratifying to note two points in this connection: the interval between the two last symposia is only about 2 years; the collaboration between universities, industrial laboratories, and government research institutions appears to be excellent. In 1945 Sir Lawrence Bragg stated in a lecture in Manchester:

Perhaps it is right to ask whether this whole field of magnetic materials is not one where pure and applied science should collaborate to put our country in a stronger position than it is at present. . . . I see a field where there may be a fine collaboration between our university laboratories and the industries which need these materials for various purposes.

The kind of conference reported in the present book is good evidence of cooperation and progress.

Two of the newest fields in ferromagnetism are *ferrites* and *high-frequency effects*. In this symposium there are five papers on the former subject and some discussion of the latter. In the last few years conferences on magnetism held in France and in America devoted larger numbers of their papers to these subjects. It is somewhat surprising to find a limited consideration of them at the conference on telecommunication materials.

The list of authors includes many names well known in the field of ferromagnetism. The principal subjects may be designated briefly as impurities, fine particles and powders, losses, lag, resonance and frequency effects, and magnetostriction. Materials that are discussed include grain-oriented silicon-iron, high permeability iron-nickel alloys, iron-nickel and carbonyl-iron powders, oriented materials with rectangular loops, and ferrites (resonance, pulse response, signal distortion, magnetostriction).

This book should be read, at least in part, by everyone seriously interested in the properties of ferromagnetic materials and in the nature of the phenomena that they exhibit.

R. M. BOZORTH

Bell Telephone Laboratories, Murray Hill, New Jersey

The Biochemistry of the Nucleic Acids. J. N. Davidson. Wiley, New York and Methuen, London, ed. 2, 1953. viii + 200 pp. Illus. + plates. \$2.25.

A remarkable amount of information about nucleic acids has been incorporated into this small volume, which is a revision and extension of the first edition (1950). The author has maintained his high standards of accuracy, clarity, and wisdom of selection. The rapid advances in our knowledge of the chemistry and biochemistry of nucleic acids during the past few years made it highly desirable that this useful volume be brought up to date.

The most extensive changes have been made in the chapter dealing with chromatographic techniques applied to nucleotide chemistry, and in the chapters dealing with the structure and properties of the polynucleotides and the mechanism of nucleic acid biosynthesis. Major changes have been made in the chapter on the cell nucleus.

In addition to a brief history of the early developments in nucleic-acid chemistry, the book contains chapters on the hydrolysis products of nucleic acids and their isolation by chromatographic procedures, the structure and properties of the polynucleotides, and nucleases and related enzymes. Techniques for studying nucleic acids *in situ* by means of ultraviolet light and by histochemical methods are discussed. The section on chemical methods for estimating nucleic acids has been brought up to date. These are followed by chapters on the cell nucleus and on the metabolism and the biosynthesis of the nucleic acids, including the most recent work using tracer techniques. The book concludes with a chapter on the biological activity of nucleic acid and a chapter on the nucleic acids in microorganisms. The only change from the first edition in the arrangement of material is that the bibliographic references now appear at the end of each chapter instead of gathered together at the end of the book. A total of 646 citations appear.

This book will undoubtedly be useful to workers in the nucleic-acid and nucleoprotein field, and it can be recommended to biochemists who are specializing in other fields, but who must also remain abreast of developments in the nucleic-acid fields. It will also be of great value to teachers of biochemistry and to biologists who wish to become familiar with the chemistry of the nucleic acids.

JOHN R. TOTTER

*Biology Division, Oak Ridge National Laboratory,
Oak Ridge, Tennessee*

Introduction to the Theory of Finite Groups.

Walter Ledermann. Interscience, New York, and Oliver and Boyd, Edinburgh-London, rev. ed., 1953. 160 pp. \$1.55.

Group theory has been assuming a role of ever-increasing importance in mathematics. Twentieth-century physics has found group theory to be the appropriate vehicle for the formulation of quantum mechanics. Similar rumblings are beginning to be heard in other scientific disciplines. The need for an introductory textbook on the subject in English is thus indisputable. This modest volume (whose first edition was published in 1949) makes available a systematic detailed discussion, with many examples to illuminate the theory. After mastering its contents, a reader will find it possible to attack with confidence the advanced treatises by Zassenhaus and Kurosh (the English translation of the latter is expected soon).

Three technical points might be mentioned where alternative expositions are possible: the use of double cosets in proving the Sylow theorems; the proof of the Jordan-Hölder theorem in a style not susceptible of generalization to infinite groups; and the proof of the basis theorem for abelian groups by factoring out a cyclic summand of maximal order. I am enthusiastic about the third but prefer an alternative route in the first two cases.

This book is a worthy member of the series of University Mathematical Textbooks, and the attractive format is admirable.

I. KAPLANSKY

Department of Mathematics, University of Chicago

Principles of Automatic Controls. Floyd E. Nixon. Prentice-Hall, New York, 1953. 409 pp. Illus. \$9.35.

This book is intended primarily as an undergraduate engineering textbook on automatic control systems. The emphasis is naturally on linear systems. The mathematical level is as elementary as possible, subject to the constraint of introducing and applying Laplace transforms and the Nyquist stability criterion to problems of system design and analysis. The first 11 chapters cover both these topics and their applications in great detail, along with discussions of various types of error compensation and effects of noise and output disturbances. There are additional chapters on useful tools and techniques, such as numerical integration methods, automatic computers, methods of transient response analysis, and nonlinear systems. Six appendixes, mostly mathematical, include a very conveniently organized one of Laplace transform pairs.

The text exudes practicality, abounds in numerical examples, and includes many exercises at the end of each chapter. The arguments are generally easy to follow but require more of a "feel" for engineering than is likely to be given to an engineering undergraduate by first-year calculus, first-year physics, or even a first course in electric circuits (the author assumes the first two and says the last would be helpful but

not essential). In my opinion, a student who has not studied alternating-current networks and learned to apply complex numbers with facility would find much of the discussion unmotivated and largely meaningless. The appendix on complex numbers seems pointless, for a reader ignorant of its contents could not learn enough from it to read the book intelligently. Expansion of Chapter 2 to include complex numbers and enough integration in the complex plane to enable the student to grasp the meaning of the Nyquist criterion (if not to follow the derivation in Appendix 6) seems desirable. On the whole, however, the textbook is suitable for senior, and possibly junior, engineering students, if their course sequence is right, or for self-study.

JEROME ROTHSTEIN

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An Rh-Hr Syllabus. The types and their applications. Alexander S. Wiener. Grune & Stratton, New York, 1954. 82 pp. Illus. \$3.75.

Rh-Hr Blood Types. Applications in clinical and legal medicine and anthropology. Alexander S. Wiener. Grune & Stratton, New York, 1954. 763 pp. Illus. \$11.50.

These companion volumes have proved to be quite a disappointment. The preface of *An Rh-Hr Syllabus* states that its purpose is to present an up-to-date summary of the subject in a compact, easily understandable form. Instead, one finds a summary of Wiener's contributions to the subject, with his personal views and theories often presented as established facts. The existence of other viewpoints and theories, which happen to be widely held by competent authorities, is either ignored or subjected to ridicule. Those familiar with this field are well aware of two major areas in which differences of opinion exist. The first concerns genetic theory, with Wiener advocating a single locus with eight allelic genes, while the theory of Fisher and Race postulates three closely linked loci with two or three alleles at each locus. Both theories explain the observed facts adequately, and both therefore merit careful consideration until such time as critical data may become available to permit a decision. The second area of difference is the existence of two systems of nomenclature. Wiener designates the Rh-Hr system, which he devised as the "international" system, but the international authority upon which this may be based is unknown to me. The CDE system suggested by Fisher and Race seems to have more currency in international usage.

When a difference of opinion regarding scientific theories exists, a proponent of any theory has every right to present his views in a monograph. However, the disputed area should be clearly defined, and the observed facts and their interpretation should be distinguished. This Wiener fails to do. The statement in the preface, "For readers not specializing in the field, it [the *Syllabus*] contains all the information they re-

quire," is clearly misleading. When a party to a controversy abandons the scientific approach and turns to ridicule of those who do not agree with him, he admits the scientific weakness of his position. Certainly the following quotation (p. 39), aimed at discrediting the Fisher-Race nomenclature, has no place in any serious publication: "To celebrate this occasion, I. M. Jaundiced, a poet residing at 36 Genotype Road, High Titer, R. H., has written a song entitled: 'C, D, E, F—Gee!!'"

In addition to the biased presentations mentioned, one also notes arbitrary changes in nomenclature of the Duffy and Kidd antigens and even in the ABO system, which apparently have no purpose other than to embarrass the CDE system of nomenclature. The clinical discussions of kernicterus and exchange transfusions leave much to be desired and again present opinions as established facts.

The larger volume, *Rh-Hr Blood Types*, consists entirely of reprints of 84 of the 333 papers in the author's personal bibliography, with the addition of occasional explanatory notes. The statement is made that this volume summarizes developments in Rh applications to clinical and legal medicine and to anthropology for the decade 1943-53. To accept this evaluation would be to ignore the work of dozens of investigators who have made important contributions during this period.

These two volumes are recommended only to those who are already familiar with the subjects discussed and who wish an authoritative presentation of Wiener's position in a controversy that is likely to continue for some time.

C. NASH HERNDON

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Planning Guide for Radiologic Installations. Wendell G. Scott, Chm., Committee on Planning of Radiologic Installations of the Commission on Public Relations of the American College of Radiology. Year Book Publ., Chicago, 1953. xvi + 336 pp. Illus. \$8.

As is stated in the preface, this manual is in answer to many requests for authoritative information on the planning of radiologic departments. Under the auspices of the American College of Radiology and the chairmanship of Wendell G. Scott, representatives of radiology, manufacturing companies, the American Hospital Association, and the like were chosen to cover certain fields in which these persons were most proficient. The result is a very carefully worked out compilation of the thoughts of these different authorities.

In studying this little volume, it is evident that in the radiologic medical "workshop," as in every other field of medicine, there must be very marked individualization to fit the particular needs of the institution or

physician. No prefabricated set of blueprints will adequately care for any particular local situation. It is clear that the radiologist who is to practice in the proposed new installation must play a large part in the design.

This book consists of 22 sections that deal with all the various phases of radiologic building and planning. Sections are devoted to studying patient-traffic and film- and technician-flow, so that economies of operation may be effected by proper planning. Architectural considerations and protection, along with many "do's and don'ts," are scattered throughout. Most of these discussions take up general principles, and the reader can and must adapt these basic fundamentals to the local problem under consideration. Any person who obtains this book with the idea that it is just a set of blueprints is badly mistaken, because this is not its purpose. There is much detail but no detail drawing.

A careful study of this invaluable contribution to radiologic and hospital architectural planning is a must for all concerned in this field.

VINCENT W. ARCHER

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Cancer of the Lung: A Symposium. Johs. Clemmesen, Ed. Council for International Organisations of Medical Sciences, Paris, 1953. 210 pp. Illus. \$6.

At the symposium in Louvain in 1952, H. L. Stewart (U.S.A.) reported on pulmonary tumors in animals. Levin (U.S.A.), Clemmesen (Denmark), de Muylde (Belgium), Dorn (U.S.A.), and Kretz (Austria) maintained that frequency of pulmonary cancer was mounting, while Steiner (U.S.A.) and Denoix (France) were more cautious and stressed the impact of steadily improving ante- and post-mortem diagnosis of lung cancer upon statistics. Of U.S. towns, London, Amsterdam, Copenhagen, Paris, and Vienna, the last named city—which for many decades has had the highest percentage of necropsies—has the highest recorded mortality from lung cancer. In Vienna, in 1931, respiratory cancer accounted for 15.8 percent (♂) and 2.7 percent (♀) of all fatal cancers; up to 1951 it rose to as much as 31.8 percent (!) and 4.6 percent, respectively. (However, in the age groups below 60, in spite of rising frequency of lung cancer, Vienna's total cancer mortality in 1951 continued the falling trend, which, in Central Europe, started 50 years ago. See *Cancer in Man*, S. Peller, International Universities Press, 1952, page 380.)

In analyzing the reasons for the spread of lung cancer, William E. Smith (U.S.A.) spoke about occupational hazards, Kennaway and Walter (England) about air pollution, and Doll (England), Hammond and Horn (U.S.A.), and Dorn and Levin dealt with smoking.

Smith is inclined to question the radon etiology of lung cancer among miners of Joachimsthal and

Schneberg and argues in favor of the arsenical genesis, which he applies also to the nickel refinery workers of Wales and to smokers. From my figures on Joachimsthal (inaccurately quoted by Smith), it appears that the miners had a lung-cancer mortality of 9.77 to 10.90 per 1000 person-years, as compared with 0.34, the highest value in the 1930's for a male population of the same age groups. Thus, as pointed out by Korteweg (Netherlands) and Clemmesen, environmental conditions may lead to a considerable further increase of lung-cancer mortality in the future.

Kennaway and Maisin (Belgium) mentioned that nuns (who do not smoke) are free of lung cancer, while Steiner and Stewart pointed out that infants do have lung cancer, although they do not smoke. (In my opinion, cancer in infants and children, whether in the lungs or elsewhere, whether leukemia, carcinoma, or sarcoma, is a response to carcinogens that the fetus received via placenta from the mother.)

A large part of the 4-day session was devoted to the question of whether the material collected proves smoking to be the main factor in lung-cancer epidemiology, and what should be recommended for further research on causative factors, on anatomical classification, on case histories of respiratory cancer, and on the minimum amount of information in statistical reports. It is a very informative symposium.

SIGISMUND PELLER

New York, N. Y.

Chemistry of Carbon Compounds: Alicyclic Compounds, vol. II, pt. A. E. H. Rodd, Ed. Elsevier, Amsterdam-Houston, 1953. 487 pp. Illus. \$12.50

This is the second volume of a series designed to present a systematic discussion of organic compounds, intermediate in size between the great encyclopedias, such as *Beilstein* and *Elsevier*, and the shorter, essentially instructional text books. This particular volume is devoted to the alicyclic compounds exclusive of terpenoids and steroids, which are to appear later as volume II, part B.

There are many ways in which the editor and contributing authors might have selected and organized the material for such an intermediate work. Actually about 20 percent (about 90 pages) of the book describes generalizations and theoretical concepts, whereas the remainder is concerned essentially with the methods of preparation and properties of individual alicyclic compounds. The main weakness of this and similar books is that there is not adequate space for either a complete discussion of the basic principles or a complete presentation of the factual data. The principal merit of this book is the excellent organization of the material.

The various ring systems are discussed in order—three-membered rings, four-membered rings, and so forth—and then for each ring system the functional derivatives, such as halogen derivatives, alcohols, and amines, are discussed in the same sequence. Frequent tables have been used to present data efficiently and to

facilitate comparisons. The most valuable part for most investigators will be the extensive references, which cover the chemical literature through 1952.

Special features are the liberal use of illustrative structural formulas and a very complete index (about 4300 entries, mostly individual compounds). The physical aspects, paper, binding, and type, are all very satisfactory; also, I noticed very few errors in either the formulas or the text material.

All the volumes of this series will undoubtedly be welcomed by organic chemists and investigators in related fields, first because of the greater rapidity with which pertinent references to the original literature may now be located, and second because this kind of reorganization of scientific knowledge frequently furnishes the inspiration for many new advances by bringing into juxtaposition facts and ideas that were formerly isolated.

RODERICK A. BARNES

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Electroanalytic Chemistry. James J. Lingane. Interscience, New York, 1953. 448 pp. Illus. \$8.50.

This book gives a more complete coverage of the various divisions of electroanalytic chemistry than any other recent book. The first seven chapters discuss in a rather classical manner the fundamental aspects of the measurement and interpretation of the emf of galvanic cells, pH and its measurement, and the various types of potentiometric titrations. Chapter 9 covers conventional conductometric analysis in a similar fashion, together with a short section on high-frequency methods. The author states that he made no attempt to make these chapters, which comprise the first 160 pages, all-inclusive of their several subjects. Instead, they present the fundamentals of these more classical branches of electroanalytic chemistry, so that a better understanding of the newer developments can be accomplished.

The remainder of the book consists of short chapters on automatic potentiometric titrations, internal electrolysis, and electrographie analysis, in addition to extensive chapters on the theory, methodology, and recent developments in the various types of controlled potential electrolysis, in controlled potential coulometry and coulometric titrations at constant current. These latter chapters are well documented by numerous references to the recent literature (to about May 1953), together with a critical appraisal, in many cases from the author's own experience.

An examination of only the first 160 pages might suggest that this book gives a rather superficial coverage of some of the older aspects of electroanalytic chemistry. However, on closer study, it is difficult to find specific omissions. Where the coverage is brief or applications are omitted completely, adequate references to more complete treatises on the subject are given. The latter part of the book is quite complete in its coverage and represents the first authoritative appraisal of these subjects. There are, however, sev-

eral techniques used in analysis that involve electrochemistry: namely, electrochromatography, ionography, electrophoresis, and ionic membrane potentials, which are not mentioned.

The size of type, general format, and well-written text make this an easy book to read and study. It should be invaluable to all chemists interested or engaged in some aspect of electrochemistry.

CLARK E. BRICKER

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The Biology of the Cryptic Fauna of Forests.

R. F. Lawrence. A. A. Balkema, Capetown-Amsterdam, 1953. 408 pp. Illus. 50s.

The subject of this book and a more precise title would be "Some features of animals found in humus in South African forests." To be sure, the author apologizes for his somewhat misleading title in the very first paragraph, so perhaps it is a little unfair to criticize on the basis of what might have been anticipated from the title. Nevertheless, the student of animal ecology and population ecology will be quite disappointed that a book on such a promising subject and with such a promising title does in fact leave out so much.

This account of the fauna of humus has been written from the point of view of the field naturalist and museum collector and with an eye to anatomical features that may indicate physiological adaptations of this specialized group of animals. There are lists of animals found in the forest floor in South Africa. Similarities in color and form of diverse groups are expounded upon. One chapter deals with the sense organs of these creatures of the dark, another with weapons of offense.

The closest we get to physiology is in a chapter on movement and one on respiration, but both accounts are primarily from the anatomical point of view. The ecologist is interested in feeding habits and numbers of animals. A chapter on food is largely concerned with specialized mouth parts and such generalizations on feeding as can be made from rather scanty observations. More on this subject is to be found in the European literature than the chapter suggests.

Regarding the numbers of animals in the forest floor, this is barely touched upon. This is a pity in view of the important work along these lines by Bornebusch and others following him. The section on methods for extracting animals from humus is quite out of date. Nor is there any reference to the quantitative study of the fauna in terms of energy transformation.

The author has simply concentrated on the particular aspects of the biology of these animals that he happens to find of intriguing interest. The result is disappointing for the ecologist and physiologist. But although the book misfires with this audience, it will serve the purpose of stimulating the interest of naturalists and systematists in a relatively little known but diverse group of animals, and their interest will be held throughout. Sometimes it is won at the cost

of rather questionable analogies (such as the analogy between the cryptic fauna and amphibians on page 138) or on odd emphases such as the emphasis on the virtual exclusion of the Onychophora from all environments save the forest floor.

Not all groups of animals found in humus are included. The rotifers are omitted on the grounds that "if such semi-microscopic and mainly aquatic groups as Rotifers are to be included in an assessment of the forest-fauna, more refined techniques for collecting them will have to be devised than the Berlese funnel." But the Berlese funnel was never designed to extract rotifers. They can be collected with techniques no more elaborate than washing leaves in water in a separate funnel and drawing off the rotifers through the tap after they have settled to the bottom.

It is not true to say that the free-living nematodes "are wholly confined to the forest habitat" (p. 36). Some of the best quantitative work on free-living nematodes has been done on bare slopes and grass fields in Denmark.

Despite omissions and misleading statements such as those mentioned, this book contains a lot to interest the biologist and the student of the fauna of the forest floor. The reading is made interesting by excellent illustrations, and the quality of the production of this publication is exceptionally good. But it cannot be regarded as an up-to-date review of the biology of the cryptic fauna of forests.

L. C. BIRCH

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Synthetische Artbildung. vols. I and II. *Grundlinien einer exakten Biologie.* Heribert Nilsson. Verlag CWK Gleerup, Lund, Sweden, 1953. 1303 pp. Illus. Paper, Kr. 225; cloth, Kr. 250.

The thesis of this elegantly printed two-volume opus is somewhat as follows.

The concept of evolution as a continuously flowing process can be proved only on Lamarckian lines, since "evolution and Lamarckism are inseparable because they include the same fundamental ideas." There is no proof from the data of genetic recombinations or mutations to support the generally accepted concept of evolution; therefore, evolution is not occurring at this time. Nor does it seem to have occurred in the past, since the fossil record is the result of the piling up and preservation of world biota during the periods when the nearness of the moon induced tremendous tidal action (the "Tethys sea") and freezing at high latitudes because of the pulling of air toward the equator hastened such preservation. During these revolutionary periods there was resynthesis of the entire world biota by gene material or gametes along the same basic lines (hence, there is no point to phylogenies, since the similarities of organic life are due to the synthetic activity of similar "gametes"); this process is termed "emication."

The author of this imposing work (there are 43 pages of references) is aware of the objections that will be raised against his theory:

I will be asked: "Do you seriously want to make such a statement? Do you not see that the consequences of such a theory are more than daring, that they would be nearly insane? Do you really mean to say that an orchid or an elephant should have been instantaneously created out of nonliving materia?"

Yes, I do. And, please, reflect, because now I am going to put a question: Is the elephant of today "ready-made"; does it not originate from gametes? You must admit the truth of the latter statement. Why, then, assume that the first elephant appeared as the fully formed animal? He was created as a gamete, unicellular, a monocyte.

For those who may be inclined to side with Lyell and against Cuvier as far as the major premises of this argument are concerned, it must be said that there is a great accumulation of information about genetic processes and the biochemical nature of chromosomes in these two volumes of fact and fancy. Such works also serve another useful function (in addition to keeping printers employed): they challenge us to tighten our own arguments, for up to the point where the author takes his flier into paleontology, his criticism of evolutionary theory is philosophically respectable.

JOEL W. HEDGPETH

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The Size and Growth of Tissue Cells. Joseph G. Hoffman. Thomas, Springfield, Ill., 1953. xv + 102 pp. Illus. \$4.

A century of investigation has left the basic questions regarding specific cell sizes in a most unsatisfactory state. Characteristic shapes and, to a lesser extent, size and staining qualities still constitute the major criterions of recognition. Pathologists long ago disagreed on the question of size alone as a characteristic of malignancy, yet the author of this small monograph wishes to reexplore the phenomena of volume increase and volume ratios from the point of view of cancer research. In his introduction he states that it was undertaken "in the belief that proper measurements and analysis of the sizes of cell parts can ultimately yield information about growth." Maybe so, but no proof is given.

It is unfortunate that so much of the book is taken up with background explanations of the importance of the problem and so little is devoted to its solution. Two short chapters discuss variations in intermitotic time periods and inadequacies of mitotic index values. In the final chapter an interesting conclusion is that the nuclei of mouse *dbr* tumor cells may grow linearly, while the cytoplasm grows exponentially. No effort, however, was made to discuss the importance of factors such as aneuploidy or fixation shrinkage. Most students of the cell will be disappointed by the volume. The real key, which biologists still lack, is a fundamental theory of the cell nucleus.

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New Books

Fortschritte der Chemie Organischer Naturstoffe, vol. 10. L. Zechmeister, Ed. Springer, Vienna, 1953. ix + 529 pp. Paper, \$19; cloth, \$19.80.

The Biochemistry of Clinical Medicine. William S. Hoffman. Year Book Publ., Chicago, 1954. xx + 681 pp. Illus. \$12.

General Chemistry. P. W. Selwood. Holt, New York, rev. ed., 1954. xii + 657 pp. Illus. \$6.

Economic Activity Analysis. Oskar Morgenstern, Ed. Wiley, New York; Chapman & Hall, London, 1954. xviii + 554 pp. \$6.75.

American Thought. A critical sketch. Morris R. Cohen. Free Press, Glencoe, Ill., 1954. 360 pp. \$5.

World Geography: An Introduction. Loyal Durand, Jr. Holt, New York, 1954. vii + 372 pp. Illus. \$5.25.

The Giant Cactus Forest and Its World. A brief biology of the giant cactus forest of our American southwest. Paul Griswold Howes. Duell, Sloan & Pearce, New York; Little, Brown, Boston, 1954. xxv + 258 pp. Illus. + plates. \$7.50.

Bilder sur Qualitativen Mikroanalyse Anorganischer Stoffe. Von Wilhelm Geilmann. Verlag Chemie, Weinheim/Bergstr., 1954. 120 pp. Illus. DM. 20.80.

Chimica Generale E Inorganica. Giuseppe Bruni. Libreria Editrice Politecnica Tamburini, Milan, Italy, ed. 9, 1954. xx + 793 pp. Illus.

General College Chemistry. Andrew J. Scarlett and José Gómez-Ibáñez. Holt, New York, 1954. x + 645 pp. Illus. \$6.

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Information Theory in Biology. Henry Quastler, Ed. Univ. of Illinois Press, Urbana, 1953. 273 pp. Illus. Paper, \$4.

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Reports on Progress in Physics. vol. XVII (1954). A. C. Stickland, Ed. Physical Society, London, 1954. 280 pp. Illus. £2 10s.

Qualitative Analysis and Chemical Equilibrium. T. R. Hoggness and Warren C. Johnson. Holt, New York, ed. 4, 1954. xiii + 621 pp. Illus. \$5.

Elements of Statistical Mechanics. D. ter Haar. Rinehart, New York, 1954. xix + 468 pp. Illus. \$8.50.

Tables Numériques de Physique Nucléaire. Charles Noël Martin. Gauthier-Villars, Paris, 1954. 258 pp. Paper, \$5.15; cloth, \$6.79.

Mathematical Thinking in the Social Sciences. Paul F. Lazarsfeld, Ed. Free Press, Glencoe, Ill., 1954. 444 pp. \$10.

Heat Transmission. William H. McAdams. McGraw-Hill, New York-London, ed. 3, 1954. xiv + 532 pp. Illus. \$8.50.

Les Constantes Physiques des Composés Organiques Cristallisés. J. Timmermans. Masson, Paris, 1953. 556 pp. Illus. F. 5200.

Beyond the Germ Theory. The roles of deprivation and stress in health and disease. Iago Galdston, Ed. Health Education Council, New York, 1954. viii + 182 pp. Illus. \$4.

Miscellaneous Publications

- Preliminary Analysis of the Fossil Vertebrates of the Canyon Ferry Reservoir Area.* Proc. U.S. Natl. Museum, vol. 103, No. 3326. Theodore E. White. 43 pp. Illus. *Mammals of Northern Colombia, Preliminary Report No. 7: Tapirs (Genus Tapirus), with a Systematic Review of American Species.* vol. 103, No. 3329. Philip Hershkovitz. 31 pp. Illus. *A Revision of the Goatfish Genus Upeneus with Descriptions of two New Species.* vol. 103, No. 3330. Ernest A. Lachner. 35 pp. + plates. *North American Triclad Turbellaria, XIII: Three New Cave Planarians.* vol. 103, No. 3333. Libbie H. Hyman. 10 pp. Illus. Smithsonian Institution, Washington 25, 1954.
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- Nuclear Technology.* A bibliography of selected AEC reports of interest to industry. TID-3050, pt. 3. 41 pp. 35¢. *Electronics and Electrical Engineering.* pt. 4. 33 pp. 35¢. *Mechanics and Mechanical Engineering.* pt. 5. 28 pp. 25¢. *Construction and Civil Engineering.* pt. 6. *Mining and Geology.* pt. 7. 21 pp. 25¢. *Industrial Management.* pt. 8. *Health and Safety.* pt. 9. 24 pp. 25¢. Industrial Information Branch, U.S. Atomic Energy Commission, Washington 25, 1954 (Order from U.S. Dept. of Commerce, Office of Tech. Services, Washington 25).
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- Information on Graduate Work in Hydraulic and Irrigation Engineering.* Div. of Civil Engineering and Irrigation, Univ. of Calif., Berkeley 4, 1954. 10 pp. Gratis.
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- Chemical Pulps and Writing and Printing Papers from Albizzia stipulata, Boivin.* Indian Forest Bull. No. 173, pt. XV. R. V. Bhat and S. R. D. Guha 9 pp. 1s. 3d. *Chemical Pulps and Writing and Printing Papers from Wattle Woods.* Indian Forest Bull. No. 174, pt. XVI. R. V. Bhat and K. C. Virmani. 13 pp. 1s. 3d. Manager of Publications, Dehli, 1953.
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- Manpower Resources in Mathematics.* A study conducted jointly by the Natl. Sci. Foundation and the U.S. Dept. of Labor, Bur. of Labor Statistics. Natl. Sci. Foundation, Washington 25, 1954 (Order from Supt. of Documents, GPO, Washington 25). 22 pp. Illus. 20¢.
- "Basic Numbers" und Polyploidie und Ihre Bedeutung für das Heterostylie-Problem.* Alfred Ernst. Druck und Verlag, Zurich, 1953. 159 pp. Illus. + plates.
- Chemistry and Chemical Engineering.* A bibliography of selected AEC reports of interest to industry. TID-3050, pt. 2. Industrial Information Branch, U.S. Atomic Energy Commission, Washington 25, 1953 (Order from U.S. Dept. of Commerce, Office of Tech. Services, Washington 25). 54 pp. 45¢.
- East-West Trade Trends.* 4th Report to Congress on operations under the Mutual Defense Assistance Control Act of 1951. Foreign Operations Administration, Washington 25, 1954. 102 pp. Illus.
- Decision-making as an Approach to the Study of International Politics.* Foreign Policy Analysis Ser., No. 3. Richard C. Snyder, H. W. Bruck, and Burton Sapin. Organizational Behavior Section, Princeton Univ., Princeton, N.J., 1954. 120 pp. Illus.
- Report of the Subcommittee on Research and Development on the Five-Year Power Reactor Development Program Proposed by the Atomic Energy Commission.* Joint Committee on Atomic Energy, Washington 25, 1954. 25 pp.
- Proceedings of the Third Meeting of the Mixed Commission on the Ionosphere.* Held in Canberra, Australia, 24-26 Aug. 1952. W. J. G. Beynon, Ed. General Secretariat of the International Scientific Radio Union, Brussels, 1953. 194 pp. Illus. \$4.
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Technical Papers

Comparison of *in Vitro* and *in Vivo* Radioiron Uptake by Pigeon Erythrocytes

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Results from recent studies on the uptake of radioactive iron by avian erythrocytes and mammalian reticulocytes *in vitro* have been described by several investigators (1-4). It seems to be generally agreed that the iron taken up by nucleated or immature red cells *in vitro* is utilized for heme synthesis in a manner analogous to that of the corresponding iron *in vivo*. The distribution of the iron taken up in pigeon red cells and a discussion of some points of difference between the results from *in vitro* and *in vivo* experiments are the contents of this report (5).

Fe^{59} was added to pigeon whole blood in amounts of 1.5 μg Fe^{59} (0.08 μc) to 5 ml of blood. Samples were then maintained in a water bath at 37°C for various periods of time. Nuclei and stroma were separated from cytoplasm by Parpart's method (6). The nuclei and stroma were washed six times, and the washings were added to the cytoplasm that had been obtained by hemolysis. Nonhemin iron was extracted from the nuclei and stroma by using the hot-pyrophosphate method described by Brueckmann and Zondek (7). Radioactivity was determined by means of a well-type scintillation counter.

Table 1 gives the data for pigeon whole blood incubated with Fe^{59} for various time intervals. Notice that after an incubation period of only 15 min an appreciable amount of radioactive iron is already taken up by pigeon erythrocytes and that this amount tends to increase as the incubation time increases. Most of the iron present in the cytoplasm is presumed to be hemoglobin iron and it, too, increases gradually as incubation continues. On the other hand, the per-

centage of iron taken up by the nuclei and stroma is relatively high at the early stage of incubation but shows a tendency to decrease during the incubation period.

The nature of the iron present in nuclei and stroma remains obscure, although several investigators (8, 9) have suggested explanations. Other investigators (3, 10, 11) have observed the presence of nonhemin iron in avian red cells, but none has decided its exact localization in the cells. Thus, a nonhemin iron extraction of the nuclei and stroma was performed in order to determine the nature of the iron in this fraction. The data in the last two columns of Table 1 show that the percentage of nonhemin iron in the nuclei and stroma is very high, particularly at the early stage of incubation. Thereafter, there is a decline. To explain the presence of radioactive hemin iron in the nuclei and stroma, we concur with the possibilities suggested by Tishkoff *et al.* (8) and Moskowitz *et al.* (9); that is, that there is contamination by hemoglobin and incorporation into some other hemin substances contained in nuclei and stroma. However, we do not believe that the problem is completely solved.

The experiments next described were designed to compare iron uptake by pigeon red cells *in vitro* and *in vivo*. Various amounts of radioactive iron were given intravenously to pigeons, and blood samples were taken by cardiac puncture at appropriate time intervals after injection. Whole blood samples were analyzed for radioactive iron content in the aforementioned manner. The results of two such experiments are given in Table 2.

The percentage of iron taken up per milliliter of packed red cells *in vivo* was much lower during the time measured than that in the *in vitro* experiments. Although there are several explanations for this observation, the most likely one is that the iron is taken up not only by peripheral red cells but primarily by erythroid precursors in the bone marrow. Conse-

Table 1. *In vitro* uptake of Fe^{59} (expressed as percentages) by pigeon erythrocytes at various time intervals and its approximate intercellular distribution.

Time of incubation (hr)	Uptake of Fe^{59} per ml of P.R.C.	Fe^{59} per ml of P.R.C.		Fe^{59} in nuclei and stroma per ml of P.R.C.	
		Cytoplasm	Nuclei and stroma	Nonhemin	Hemin*
Expt. 1					
1/2	1.69	43.2	59.6	43.0	16.6
1/2	3.78	70.8	42.4	31.2	11.2
1	4.84	74.2	25.2	14.6	10.6
6	8.30	84.0	11.0	6.3	4.7
Expt. 2					
1	4.06	60.2	41.2	31.0	10.2
3	7.18	71.3	28.2	21.0	7.2

*Hemin Fe^{59} obtained by the subtraction of nonhemin Fe^{59} from percentage of Fe^{59} in nuclei and stroma.

Table 2. *In vivo* Fe⁵⁹ uptake (in percentages) by pigeon erythrocytes and its intercellular distribution at various time intervals after intravenous injection.

Time after injection (hr)	Uptake of Fe ⁵⁹ per ml of P.R.C.	Fe ⁵⁹ per ml of P.R.C.		Fe ⁵⁹ in nuclei and stroma per ml of P.R.C.	
		Cytoplasm	Nuclei and stroma	Nonhemin	Hemin
Expt. 3 (Pigeon weighing 320 g was given 22 µg (1.2 µc) of Fe ⁵⁹)					
1/2	1.18	92.5	8.12	1.12	7.00
1 1/2	1.64	93.4	7.70	1.24	6.46
2	1.66	97.0	7.60	1.11	6.49
3	1.88	93.5	8.00	2.11	5.89
Expt. 4 (Pigeon weighing 359 g was given 18 µg (0.96 µc) of Fe ⁵⁹)					
1/2	0.62	92.5	7.42	3.80	3.62
2	1.35	92.0	8.07	4.06	4.01
3	1.81	93.5	6.19	2.65	3.54
4	2.20	94.0	6.00	1.90	4.10

quently, the length of time of the experiments was too short to permit the appearance of large amounts of Fe⁵⁹-labeled hemoglobin in peripheral red cells. As was expected, the data show a low uptake of iron by the peripheral erythrocytes during the time this was being measured.

A comparison of the data in Tables 1 and 3 reveals that there is a noteworthy difference in the mechanism of Fe⁵⁹ uptake by pigeon erythrocytes *in vitro* and *in vivo*, especially in the early stages of incubation. During the time of incubation, the amount of iron taken into nuclei and into stroma in *in vivo* experiments was remarkably lower, and the percentage of Fe⁵⁹ in the cytoplasm was considerably higher, than that seen *in vitro*.

The experiments covered by Table 3 were designed

to determine whether there is a difference in the nature of the nonhemin iron present in nuclei and stroma after *in vitro* and *in vivo* uptake. Pigeon whole blood was incubated with Fe⁵⁹ for 15 min, washed three times with iron-free isotonic saline, and then resuspended to its original concentration in iron-free isotonic saline (see A), in isotonic saline containing 107 µg percent of stable iron (see B), or in pigeon plasma (serum iron 105 µg percent) (see C). The samples were then reincubated, respectively, for 1 or 3 hr in a water bath at 37°C. For comparison, a pigeon weighing 260 g was given 12 µg (0.64 µc) of Fe⁵⁹ intravenously and was bled after 18 hr. The red cells were separated from the plasma, washed three times, and then incubated in iron-free isotonic saline (see D).

Table 3. Comparative alterations in Fe⁵⁹ (in percentages) taken up both *in vitro* and *in vivo* by pigeon erythrocytes after washing with mediums containing various amounts of iron.

Time of reincubation (hr)	Fe ⁵⁹ per ml of P.R.C.	Fe ⁵⁹ per ml of P.R.C.		Fe ⁵⁹ in nuclei and stroma per ml of P.R.C.	
		Cytoplasm	Nuclei and stroma	Nonhemin	Hemin
Section A					
Before reincubation	100.0	37.1	64.8	56.4	8.4
1	85.6	42.0	50.0	41.5	8.5
3	57.0	45.2	20.0	15.1	4.9
Section B					
Before reincubation	100.0	25.4	72.8	59.8	13.0
1	85.3	33.5	57.0	39.3	18.7
3	79.8	35.3	49.4	38.5	10.9
Section C					
Before reincubation	100.0	25.4	72.8	59.8	13.0
1	80.5	32.7	53.6	47.5	5.1
3	72.4	36.5	44.2	30.1	14.1
Section D					
Before reincubation	100.0	81.0	20.4	12.1	8.3
1	97.2	81.2	17.8	10.0	7.8
3	91.2	81.2	16.8	8.0	8.6

The data show that the radioactive iron, which is taken up by pigeon erythrocytes *in vitro*, leaves the cells during reincubation in the various media described. This is particularly evident in the iron-free medium. However, the percentage of Fe⁵⁹ present in cytoplasm increased during reincubation, whereas the percentage of Fe⁵⁹ present in the nuclei and stroma declined, primarily because of a considerable drop in the nonhemin iron fraction. This strongly suggests that the nonhemin iron in nuclei and stroma can be utilized for hemoglobin synthesis and that it may be in equilibrium with the iron in the suspending medium. In contrast to these observations, the iron, which is taken up by pigeon red cells *in vivo*, is comparatively stable and undergoes only a very slight decline, which is attributable to the nonhemin iron fraction of nuclei and stroma.

This fact suggests the possibility that the iron taken up by pigeon erythrocytes *in vitro* at the early stage of incubation is attached or combined loosely to the surface of the cells and may be in equilibrium with iron present within them, particularly in the nuclei and stroma.

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New Method of Intracoelomic Grafting

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The technique of intracoelomic grafting, originally described by Hamburger (1, 2), has found wide application in the field of experimental embryology, and the results obtained through its use have contributed much to our understanding of developmental processes. The technique in its present stage of development (3) has, however, certain inherent limitations that restrict its usefulness. One drawback is that the size of the implant is limited both by the small capacity of the coelom of 60- to 70-hr-old chicks and by the necessarily small incision permitted in gaining access to it. For these reasons, successful implantation of relatively large bits of tissue—for example, approximately 0.5 to 1.0 mm³—is not practicable.

During a recent investigation, it became necessary

to make intracoelomic grafts of the thyroid glands of 10- to 11-day-old chick embryos. It was soon discovered that implantation of a half or even a quarter of such a gland was difficult, if not impossible, and that the results to be expected from such a procedure were highly questionable. To circumvent this impasse, a new approach was required. The method that was finally developed appears to have sufficient applicability to be of interest to workers in fields other than embryology.

By 3½ days of development (4, Hamburger-Hamilton stage 20), the chick embryo lies entirely on its left side, the allantois is beginning to expand, and the embryonic membranes have grown completely over the embryo and have separated into chorion and amnion. The embryonic coelom and the extraembryonic coelom are still in broad communication at this time, for the umbilical ring has not yet been occluded by the structures that pass through it. Beginning with the time that the embryo first comes to lie completely on its side and ending with the time that the allantois has expanded to such a point that the site of operation is obstructed (approximately Hamburger-Hamilton stage 23), the coelom of the chick is readily accessible for operative manipulations and is in a condition such that tissue placed within its confines readily becomes vascularized.

The operation itself is extremely easy and rapid. The egg is opened in the usual manner, and the embryo is lowered by withdrawing a small amount of albumen from the pointed end of the egg. The opening required in the chorion (Fig. 1 *A* and *B*) may be made either by cutting with iridectomy scissors or by tearing with fine watchmaker's forceps, and should be just large enough to admit the graft; it is essential to distinguish carefully the chorion and amnion and to avoid injury to the latter. The graft is temporarily placed on the chorion next to the incision, and, to facilitate its placement and later recovery, it is marked with a few grains of sterile blood carbon or, alternatively, with a vital dye. Using an L-shaped blunt glass instrument (Fig. 1), the graft is nudged into the incision and gently pushed past the anterior face of the allantois through the umbilical ring. Upon reaching the dorsal surface of the embryonic coelomic cavity (Fig. 1 *B*), the graft may be directed toward the posterior portion of the cavity and pushed into a secure position. It is quite possible to push the graft into the anterior portion of the coelomic cavity at this point. The carbon particles are usually visible through the flank of the embryo and will indicate by their location whether or not the graft has become firmly lodged in the desired location. The volume of tissue grafted is largely dependent upon its shape. A spherical or cubical graft having a volume approaching that of a thin elongated graft is more difficult to implant than the latter, which may be inserted without unduly distorting the embryo. When the graft has been placed in position, the albumen is replaced, the shell window is fitted into place, and both openings are sealed with melted paraffin.

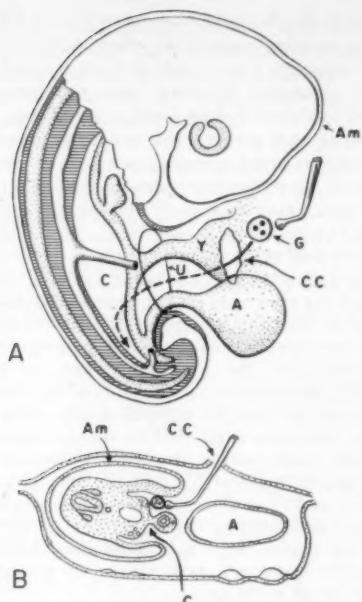


Fig. 1. (A) Diagram of 4-day-old chick embryo with right body wall removed; the arrow shows the path along which the graft moves during implantation. (B) Diagrammatic cross section through 4-day-old chick embryo showing membranes and the path followed by the graft during the first phase of implantation. Symbols: *A*, allantois; *Am*, Amnion; *C*, coelom; *CC*, cut edge of chorion; *U*, umbilical ring; *G*, carbon-marked graft; *Y*, yolk stalk. (Both diagrams modified after Patten, 1927.)

Within a period of approximately 24 hr, the graft becomes vascularized and firmly attached. At recovery, grafts have been found attached to the mesonephros, intestine, umbilical blood vessels, or body wall. Differentiation of the graft is excellent. Chick limb buds have produced well-defined bone, cartilage, skin, and muscle. One portion of the ventricle of a 3-day-old chick embryo differentiated into a vesicle of pulsating heart muscle. The floor of the pharynx, consisting of pharyngeal entoderm, thyroid vesicle, and mesenchyme, formed normal thyroid tissue, cartilage, bone, and gut epithelium.

Successful takes of both guinea-pig and rat tissues have been reported (5). It is to be emphasized, however, that the quality of graft differentiation obtained by means of this method is in no way different from the results afforded by the Hamburger method. This method does have the advantage not only of admitting use of larger pieces of tissue or organs as grafts but also of allowing the operator to utilize older embryos as hosts. The mortality rate from the operation appears to be very low (less than 2 percent). The method is less favorable for very small grafts, which cannot be firmly wedged into place during the implantation procedure and may subsequently be lost because of

the movements of the embryo. For this reason, the technique is no substitute for Hamburger's method but is designed to complement it.

The method suggests a number of applications. The possibility of implanting a relatively large piece of tissue, as well as being able to place it with some accuracy next to a developing organ—for example, the heart, kidney, and so forth—may be of value in pathology and cancer research. The effects of hormones, drugs, inhibitors, and other chemicals on embryonic processes might be studied by incorporating such substances in an inert solid carrier and similarly inserting them into the coelom. The method seems simple enough to be useful as a routine laboratory experiment in experimental embryology.

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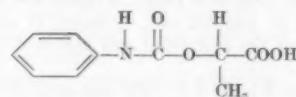
29 March 1954.

Structural Modification That Increases Translocatability of Some Plant-Regulating Carbamates

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The growth-modifying and herbicidal effects of isopropyl N-phenylcarbamate (IPC) and isopropyl N-3-chlorophenylcarbamate (3-Cl-IPC) have been reported (1-7). These compounds are apparently not readily translocated when applied to relatively mature leaves of grasses. Foliar applications have comparatively little effect on plants, whereas soil applications prevent growth of many kinds of germinating seeds, particularly those of grasses. The discovery that alpha-methoxyphenylacetic acid (MOPA) is readily translocated by the roots, stems, and leaves of plants (8) led to experiments with two carbamates, laetic acid N-phenylcarbamate (LPC) and laetic acid N-3-chloro-



phenylcarbamate (3-Cl-LPC) (9). Structurally, MOPA and these carbamates each have a carbon atom in an alpha position with respect to a carboxyl group and in each this carbon is associated with a hydrogen and a methyl or a methoxyl group.

Approximately 50 µg of the compound being tested was applied in a carrier made of 4 pt lanolin and 1 pt Tween 20 to each first leaf (3 cm long) of barley

plants (Wong var.). In this and succeeding experiments (carried out in a greenhouse) 6 to 12 plants were used for each type of treatment. A thin layer of the paste containing either LPC or 3-Cl-LPC was applied to a 1-cm² area on the upper leaf surface midway between the tip and the base; IPC, 3-Cl-IPC, and the carrier alone were applied separately to other barley plants for comparison. The IPC-, 3-Cl-IPC-, and carrier-treated plants grew vigorously, whereas the LPC- and 3-Cl-LPC-treated ones failed to grow. Six weeks after treatment some leaves of the LPC- and 3-Cl-LPC-treated plants were partially decayed, and finally the plants died.

In a subsequent experiment, 3-Cl-LPC again prevented growth when placed on the first leaf of young barley plants, whereas 3-Cl-IPC failed to do so. In contrast, both compounds prevented growth when applied to the leaf sheath just below the soil level; 3-Cl-LPC was translocated by the leaves to the crown, whereas 3-Cl-IPC was not translocated from a distant portion of the leaf to the crown in sufficient amounts to affect growth measurably.

To determine whether 3-Cl-IPC evaporated (10) before absorption could take place, about 50 µg of the compound was applied to the first leaf of each plant. Fresh paste was applied 2 and 5 days later on other areas near the original ones. Growth of the plants was not measurably different from that of comparable plants treated with the carrier alone. When the paste containing 3-Cl-IPC was removed from the leaves 2 days after application and placed on barley seeds, it prevented germination, whereas the carrier alone did not suppress germination.

Application of 3-Cl-LPC to an area (0.5 cm²) at the tip of the first leaf of barley plants reduced rate of growth only 22 percent during the following 2 wk, indicating that the compound was less readily translocated from this area than from an area nearer the base of the leaf. The leaf-tip treatment induced growth of lateral buds, and at the end of 2 wk the treated plants had developed more leaves than had the controls. Plants treated with 3-Cl-LPC on the tip of the second or the third leaf responded in a similar way. Roots of six young barley plants were suspended in aerated nutrient solution containing 10 ppm of 3-Cl-LPC, and roots of six others were suspended in aerated nutrient solution as controls. During the following week growth in length of roots and leaves was suppressed 37 percent, and of leaves 47 percent, indicating that the compound was absorbed and translocated.

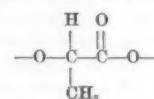
When 3 or 6 µg of 3-Cl-LPC was applied to the first leaf of young barley plants, growth of subsequent leaves was reduced 36 and 59 percent, respectively, during the 2 wk following treatment. Twelve micrograms reduced their growth 95 percent, and 24 µg completely prevented it.

Leaves of various species of grass translocated 3-Cl-LPC, but the plants varied in their responsiveness to leaf applications (lanolin-Tween 20 paste) of the chemical. Barley, oats, ryegrass, and Alta fescue

treated in the first-leaf stage were 70, 53, 34 and 21 percent shorter, respectively, than controls 12 days after treatment. Corn plants did not respond to this type of treatment. However, when the chemical was applied to the soil before germination of corn, or was sprayed on corn plants a few days after germination, it greatly retarded growth. Sprayed on respective groups of young barley plants at 125, 250, 500, or 1000 ppm, the compound completely suppressed growth. At the lowest dosage level, each barley plant received about 10 µg of 3-Cl-LPC.

LPC, 3-Cl-LPC, and the sodium salt of 3-Cl-LPC (11) did not evaporate readily from leaf surfaces. In a study of volatility, groups of 12 primary leaves of young bean plants were dipped in aqueous mixtures (500 ppm) of the compounds just named and 3-Cl-IPC. After the leaf surfaces were dry, the leaves were placed in gastight cellophane bags, four leaves per bag, and were supported 10 cm above germinating barley seeds within the bags. Untreated leaves were similarly enclosed for controls. During a period of 6 days at 70° to 90°F, further germination of the seeds was prevented by the vapors of 3-Cl-IPC. Barley in the control bags and in all bags with leaves given other treatments grew vigorously and attained a height of 40 to 50 cm.

The following compounds (12) related to LPC were readily translocated when applied to barley leaves: α -carbo (2-chloroethoxy)ethyl N-phenylcarbamate, α -carboethoxyhexoxyethyl N-phenylcarbamate, α -carbo-(2,4-dichlorophenoxy)ethoxyethyl N-phenylcarbamate, α -carbobenzoxyethyl N-phenylcarbamate, α -carbododeoxyethyl N-phenylcarbamate, α -carbobutoxyethyl N-phenylcarbamate, α -carbobutoxyethyl N-3-chlorophenylcarbamate, and α -carbobutoxyethyl N-3-cyano-phenylcarbamate. Each of these compounds has within its structure the "lactic acid" group



The carbamates (13) α -carbobutoxyethyl N-methyl-N-phenylcarbamate, α -carbobutoxyethyl N-3-nitrophenoxy-carbamate, α -carbobutoxyethyl N-3-methylphenylcarbamate, containing the "lactic acid" group were tested by stem treatment of barley plants, but they induced no visible response. These compounds, too, may be readily translocated, but some means other than growth modification would be required to detect their movement.

The following closely related carbamates (14), which do not have the "lactic acid" group within their structure, were not translocated by leaves of barley plants but they greatly affected growth when placed near the crown of the plants: IPC, 3-Cl-IPC, isopropyl N-3-cyano-phenylcarbamate, 2-propynyl N-phenylcarbamate, and ethyl N-phenylcarbamate.

Leaves of plants used (with the exception of corn) were able to translocate plant-regulating carbamates

containing the "lactic acid" group but were unable to translocate those that did not contain this group. If incorporated into the structure of some other plant regulators or pesticides, the "lactic acid" group may also enhance their translocability.

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Enzymatic Oxidation of DPNH by Diketosuccinate and Dihydroxyfumarate

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In the course of an investigation (1) of pyridine nucleotide dehydrogenases in higher plants, we have observed that various plant extracts catalyze an oxidation of DPNH (2) by diketosuccinate. Preliminary experiments indicate that such an enzyme is widely distributed in the roots, seeds, and leaves of higher plants and in animal tissues as well. The more detailed experiments described here have been done mainly with preparations from pea roots.

Because diketosuccinate is decarboxylated rapidly in aqueous solution (3), it was necessary to show that the enzymatic oxidation of DPNH is due to the diketosuccinate itself and not to its decarboxylation product. On standing at room temperature, solutions of diketosuccinic acid lost their ability to oxidize DPNH enzymatically within 20 to 40 min. The rate of loss of enzymatic activity paralleled the rate of decarboxylation. This showed that the enzymatic oxidation is not due to the decarboxylation product.

The enzyme has tentatively been called diketosuccinate reductase. The product of the reduction of diketosuccinate has not yet been unequivocally identified. However, a substance that reduces 2,6-dichlorophenol indophenol (4) accumulates when the reduction of diketosuccinate is coupled with the oxidation

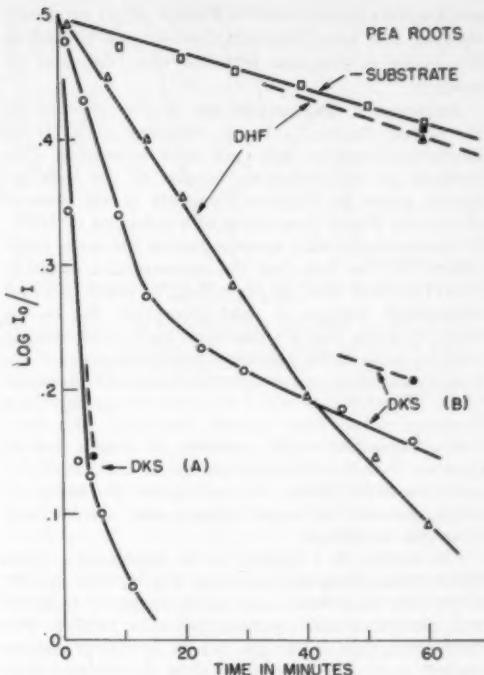
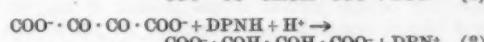
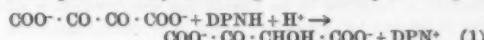


Fig. 1. The oxidation of DPNH by diketosuccinate (DKS) and dihydroxyfumarate (DHF). The enzyme was a dialized extract of an acetone powder prepared from pea roots. Each reaction mixture contained 0.1 ml of enzyme, 0.2 ml of 0.5M phosphate buffer of pH 6.5, DPNH as shown, and substrate, made up to a total volume of 3.0 ml. The open circles with solid lines indicate aerobic conditions; the solid circles with dashed lines indicate anaerobic conditions (N_2 freed from O_2 with yellow P). The dihydroxyfumarate was prepared according to Hartree (9), and the diketosuccinate according to Fenton (3). Both substrates were added as solids at the beginning of the experiment to avoid preliminary decomposition.

of ethanol in the presence of diketosuccinate reductase, alcohol dehydrogenase, and DPN^+ . This may be regarded as partial evidence that the reduction product is either α -keto- β -hydroxy succinate or an enediol form of this compound. These substances are interconvertible in solution. The reaction may be formulated provisionally according to either Eq. 1 or Eq. 2.



Equation 1 would be preferred from analogy with other pyridine nucleotide dehydrogenase reactions.

The enediol of α -keto- β -hydroxy succinic acid is available as a solid; Hartree (5) and Gupta (6) have shown that this solid is dihydroxyfumaric acid and

not dihydroxymaleic acid, as Fenton (7, 8) originally thought. The term *dihydroxyfumaric acid* is used in this paper to designate both the keto form and its enediols.

Attempts to demonstrate the enzyme reaction in the reverse direction—that is, reduction of DPN⁺ by dihydroxyfumarate—have not been successful. Dye methods are unsatisfactory because of the high reducing power of dihydroxyfumarate in the absence of enzyme. Direct observation of a reduction of DPN⁺ by spectrophotometric measurement at 340 m μ is made difficult by the fact that the concentration of dihydroxyfumarate must be kept small in order to avoid appreciable changes in light absorption due to the substrate alone (5). Furthermore, such measurements must be made under anaerobic conditions, since dihydroxyfumarate causes an enzyme-dependent oxidation of DPNH when it is added to a reaction mixture in a Beckman cuvette under aerobic conditions. This reaction is dependent on the presence of oxygen and is, thereby, sharply differentiated from the enzymatic oxidation of DPNH by diketosuccinate. The latter reaction proceeds at equal rates under aerobic and anaerobic conditions.

The results of a typical set of experiments illustrating these facts are shown in Fig. 1. The experiments were done with a pea root preparation buffered with phosphate and supplemented with DPNH. The light absorption at 340 m μ due to DPNH is plotted against time. The solid lines show the change that occurred when no precautions were taken to exclude oxygen. A precise duplicate of each reaction mixture was prepared under anaerobic conditions, opened at an appropriate time, and transferred immediately to a cuvette for spectrophotometric reading. The solid points represent the values thus observed. The upper curve shows the slow decline in DPNH in the absence of added substrate. This change is the same anaerobically and aerobically. An anaerobic incubation mixture with added dihydroxyfumarate (0.2 mg) contained as much DPNH after 60 min as the samples without added substrate, whereas the DPNH was almost completely oxidized when the same amount of dihydroxyfumarate was added aerobically. When diketosuccinate was added, on the other hand, the anaerobic and aerobic changes were equal within the limits of experimental error. Two sets of experiments are shown on the graph. Curve A was obtained with about 2 mg of diketosuccinate. Curve B was obtained with 0.2 mg of diketosuccinate and shows the marked decline in the reaction rate at about 20 min. This decline is believed to be due to the disappearance of the substrate by decarboxylation. The diketosuccinate does not oxidize DPNH in the absence of enzyme and TPNH cannot be substituted for DPNH in the enzyme reaction.

The results obtained with dihydroxyfumarate can be explained by the rapid autoxidation of the compound to diketosuccinate. The autoxidation occurs spontaneously and is also accelerated by an oxidase widely distributed in plants (10-12). The diketosuccinate so

formed must then be reduced by the DPNH and diketosuccinate reductase. The reductase thus provides a link between any DPN-reducing system and dihydroxyfumaric acid oxidase. The possibility that a system of this nature may function in plant respiration has been suggested by Szent-Györgyi and his collaborators (11, 12). Diketosuccinate reductase furnishes the hitherto missing reducing system (15) [See (16), however].

A full evaluation of the results obtained with dihydroxyfumarate must take into account not only the autoxidations but also the decarboxylation of this substance (17, 18). In some plant preparations, for example, the anaerobic decarboxylation product of dihydroxyfumarate oxidizes DPNH enzymatically, and the dependence of the dihydroxyfumarate-DPNH reaction on oxygen is thereby partially obscured. A more detailed description of the nonenzymatic and enzymatic reactions that diketosuccinate and dihydroxyfumarate undergo will be presented elsewhere.

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Stability and Absorption Spectrum of Malononitrile

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The investigation of Hydén and Hartelius (1) into the effects of malononitrile on neuronal metabolism and mental disease aroused much interest in its mechanism of action and possible therapeutic value. They stated (1):

It is possible by means of a chemical agent—in this case malononitrile—to stimulate the large nerve cells of the central nervous system to an increased production of nucleic acid and protein substances.

This appears to take place through stimulation of the protein producing system of the nerve cell to increased activity.

This *in vivo* effect of malononitrile as a stimulant to nucleoprotein synthesis has not been substantiated by American investigators. None of the American studies reported spectrophotometric analysis of the malononitrile solutions used. The experiments (2) described here show that such measurements are essential.

Materials and methods. Samples of malononitrile in crystalline form were obtained from several sources: Eastman Kodak Company, The Schering Corporation, Nutritional Biochemical Company, and Schwartz Laboratories. In addition, a 5-percent aqueous solution of $\text{CH}_2(\text{CN})_2$ specially prepared by the Astra Chemical Company was obtained through the courtesy of Holger Hydén of the faculty of medicine in Göteborg, Sweden. The solution was said to have been "stabilized" by the addition of a simple substance. (This is discussed further in a later section.) It was the same solution used by Hydén and Hartelius in their original experiments.

Samples of the American-made malononitrile were prepared in 0.07M concentration for ultraviolet spectrophotometric study and allowed to stand at room temperature in daylight. Readings were taken at various intervals up to 104 days. In the visible region of the spectrum, peak concentrations of 1.5M and 0.15M were run in addition to the 0.07M solutions. Extinction coefficients used in plotting the spectra of these preparations are all based on the original concentrations of the malononitrile in solution.

The spectrum of the malononitrile solution prepared by the Astra Chemical Company was run in 0.01M concentration. This preparation was received as a 5-percent aqueous solution (0.75M); this was removed from the bottle with a syringe and diluted in a volumetric flask. The recordings were made with the Beckman DU spectrophotometer. The slit widths used for malononitrile solution peak recordings were 0.75 mm at 268 m μ and 0.20 mm at 358 m μ .

Results. Melting-point determinations were run on desiccated samples of malononitrile. The melting point of all samples of American manufacture was found to be $30^\circ \pm 1^\circ\text{C}$. The Astra compound was evaporated to dryness in a vacuum desiccator. It showed no sharp melting point, but part of the sample melted at 30° and another part at 70°C .

The pH of all samples was determined and found to be on the acid side; a 1.0M solution had a pH of about 5, and a 0.1M solution had a pH of 6. There was no significant change in the pH of the solutions on standing for 20 days.

The Liebig titrimetric and alkaline picrate colorimetric tests for cyanide ion gave indication in all samples tested of 0.1 to 0.3 percent cyanide ion. It is felt, however, that these results may not be reliable in that they could be due to the presence of such substances as isonitriles.

Spectra of the various malononitrile samples were

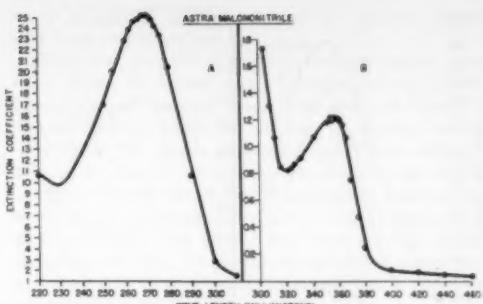


Fig. 1. Spectrum of $\text{CH}_2(\text{CN})_2$ prepared by the Astra Chemical Co., Sweden. (A) Ultraviolet absorption spectrum, showing the peak at 268 m μ . (B) Absorption spectrum in the visible region, showing the peak at approximately 358 m μ .

obtained in both the visible and the ultraviolet. Hydén and Hartelius (1948) had published the ultraviolet absorption spectrum for the Astra malononitrile employed in their experiments. Plotting extinction (which we call absorbance—not extinction coefficient) against wavelength, they reported a peak at 2700 Å with an absorption maximum of approximately 0.53. The spectrum obtained in our laboratory for an Astra sample shows a similar peak at 268 m μ with an extinction coefficient of 25 (Fig. 1A). Readings taken on this sample in the visible region show a second peak at 358 m μ with a relatively low extinction coefficient of 1.3 (Fig. 1B). This region of the spectrum was not reported by Hydén and Hartelius.

When freshly prepared in aqueous solution, none of the American-made products showed any peaks, either in the ultraviolet or visible regions; rather they showed a gradual decrease in absorbance in the direction of the region of longer wavelength. However, when these solutions were allowed to stand at room temperature, with the passage of time, a steady increase in absorbance was noted leading to peak for

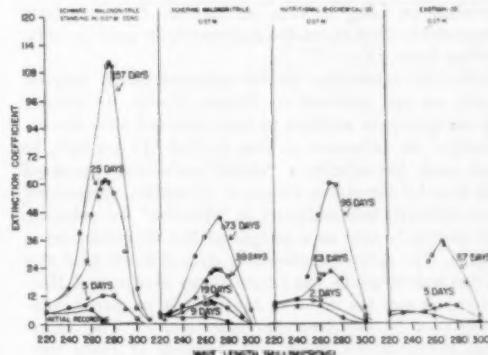


Fig. 2. Absorption spectra of American- and Swedish-made $\text{CH}_2(\text{CN})_2$ in aqueous solutions in the ultraviolet and visible regions, showing the changes with time.

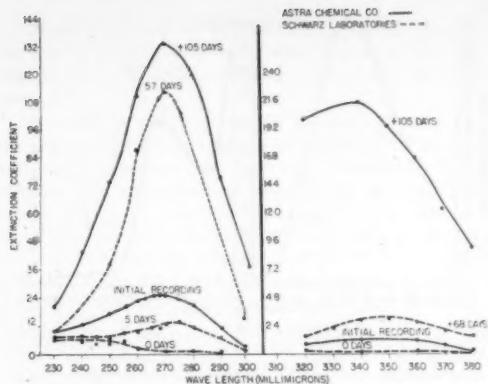


Fig. 3. The effect of the passage of time on the ultraviolet absorption spectra of aqueous solutions of four different samples of American-made $\text{CH}_3(\text{CN})_2$. In each case, the curve nearest the abscissa represents the initial recording.

mation at both 268 and 358 m μ . Different rates of change were observed for different samples (Fig. 2). Although little change was evidenced by the Astra solution when stored under refrigeration in the dark, a dilute aqueous solution (0.01M) of the Astra product kept at room temperature also showed an increase in extinction coefficient of the peaks at both 268 and 358 m μ (Fig. 3).

Discussion and conclusions. When the malononitrile samples arrived, it became apparent almost at once that they were not stable; that is, some decomposition process was occurring, as evidenced by the formation of a brownish liquid, no matter under what conditions the samples were kept, such as in the dark and under refrigeration. Upon inquiry, additional information relative to this problem was obtained from two sources. The Schering Corporation stated that this substance was unstable, as evidenced by a steady increase in the amount of malononitrile necessary to produce an LD₅₀ in rats, an increase that was time dependent—that is, as the malononitrile aged in crystalline form (3).

For the remainder of our information in this regard, we are indebted to Holger Hydén. In answer to our query on whether he had observed such decomposition, he informed us that he had. As a result, he had used, henceforth, a "stable" substance prepared for him by the Astra Chemical Company. Something was added by this company to "stabilize" the solution. He promptly sent us a sample of this Swedish preparation. Our spectrophotometric data indicate that this Astra malononitrile (as employed by Hydén and Hartelius) is not the same as the freshly prepared solutions used by the American investigators. The American preparations, when left standing at room temperature for a long enough period of time, develop the same spectral characteristics as the Astra compound. Different samples of American malononitrile

changed at different rates. This may be a result of the presence of different concentrations of impurities that catalyze the reaction. Two conclusions can be drawn from this observation: (i) The Swedish preparation is not malononitrile stabilized in its pure state but appears to be a partially stabilized decomposition or reaction product, and (ii) It is not necessary to add any other substance to the malononitrile (as Astra did) to produce this so-called "stabilized" substance, since it appears in aqueous solutions of the American products merely as a result of the passage of time.

The present experiments showed that, under certain conditions, the Astra product also changes with the passage of time; that is, the absorbance at the 268 and 358 m μ peaks increases, as is the case with the American product. Consequently, in regard to this factor at least, it is evident that the Astra compound is not a truly "stable" one.

Many things could be happening to such malononitrile solutions, such as polymerization, formation of cyclic structures, and so forth; but, until further detailed information is obtained relative to this question, no more can be said than that the malononitrile does undergo a change, by which a second and different substance is formed. Thus, it becomes obvious that the compound used by Hydén and Hartelius was in all likelihood a reaction product of malononitrile or a mixture of malononitrile and its reaction products. *The fresh solutions used by other investigators, since they were not of the same chemical structure, would not be expected to have the same biological activity. On the basis of these findings, it would appear that a reevaluation of the usefulness of malononitrile in the therapy of mental disease must be made.* These data may help to explain why the numerous reports dealing with the role of malononitrile in therapy (4-6) of mental disease, as well as other diseases involving nucleoprotein metabolism in the central nervous system (7-9), have differed in certain respects from one another and, in general, from that of Hydén and Hartelius.

The question that arises concerns the action of the aged solution. In accordance with the findings of Hydén and Hartelius, it is possible that nucleoprotein stimulation could be part of an initial "excitatory" period following interference with cellular oxidative mechanisms, but it is also possible that these two factors are completely independent of each other. We face, therefore, several complex problems: (i) What is the structure of the active substance? (ii) What is its specific action *in vivo* as compared with the results obtained *in vitro*? (iii) Is there a therapeutic effect of the active substance?

The structure of the active substance is not merely of academic interest. It may be that this is one of that group of substances whose combination with specific cell constituents is dependent on particular molecular structure or reactive groups. It is hoped that investigations of the infrared spectra, which are under way, may provide some information in this regard. If studies of other dinitriles should show this to be so, then

Ferguson's principle could be applied—namely, substances that are present at the same proportional saturation in a given medium have the same degree of biological action—and indication could be obtained regarding the presence or absence of structurally specific or nonspecific action. This principle has already been fruitful in biological investigation; for example, in studies of action of narcotics (10). Future experiments are being designed with this in mind.

SUMMARY

1) Spectra in the ultraviolet and visible regions have been obtained on samples of malononitrile under different conditions. The samples were manufactured by several companies in America and Sweden.

2) The spectral analysis has demonstrated that the compound used by Hydén and Hartelius is not the same as that employed by American investigators. If, however, an aqueous solution of the American product is allowed to stand at room temperature for a long enough time, it develops the same spectral characteristics as the Swedish solution.

3) Future studies will concern themselves with attempts to identify the active substance and to examine its effect on neuronal nucleoproteins.

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Stimulus Control of Food- and Shock-Maintained Behavior

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This paper presents a technique for maintaining behavior in a rat that is alternately under the control of shock avoidance and food reinforcement (1).

Sidman described a conditioning procedure that maintained a constant rate of bar pressing when each bar press postponed a brief electric shock (2). Techniques have also been developed for maintaining lever pressing by following lever-pressing responses intermittently with food. Moment-to-moment rate changes have been generated that are both reproducible and a function of how reinforcement is made contingent upon the bar press (3-5). Under both of these techniques, the momentary rate, as well as the day-to-day level of responding, are sensitive base lines for the

study of the control of behavior by noxious stimuli and food reinforcement.

Alternate periods of buzzer and no buzzer were used. When the buzzer was off, the Sidman-avoidance procedure was in force. Each lever press postponed a 1/5-sec electric shock by 30 sec. If no bar presses were made, the shock recurred every 30 sec. After 8 min of avoidance procedure, the buzzer was turned on, the shocking circuit was disconnected, and the first lever press occurring after 8 min was followed by a pellet of food. The buzzer was then turned off, the program reverted to the shock-avoidance procedure, and the cycle was repeated. Two cumulative recorders operating in tandem recorded the lever presses that occurred during these alternate periods of buzzer on and buzzer off.

Figures 1 and 2 are cumulative response curves after 120 hr of the avoidance and food behavior. The rat behaved appropriately to the food- and shock-avoidance schedules. When the buzzer was off and the shock-avoidance procedure was operating, the bar pressing occurred at a constant rate of 6 responses/min. When the buzzer was on and the food-reinforcement procedure was operating, the rate of lever pressing was zero for 1 to 2 min after the receipt of a food pellet; during the remainder of the 8-min period, the rate increased gradually to a terminal rate of about 60 responses/min. The diagonal marks on the food record indicate where a food pellet was delivered. Similar curves were recorded for two other rats.

The behaviors under the two schedules show little effect upon each other. The constant rate of emission

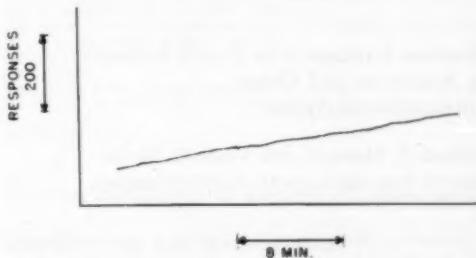


Fig. 1. Each bar press postpones a brief electric shock for 30 sec.

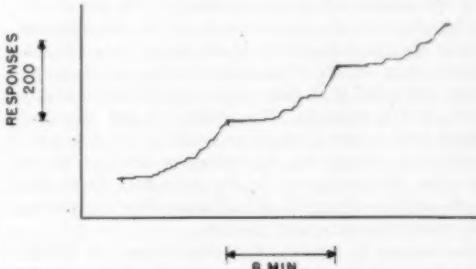


Fig. 2. The first bar press after 8 min produces a pellet.

of the avoidance responses within each experimental period and day-to-day reproducibility confirm Sidman's results. The food curve in Fig. 2 is similar to records of pigeons and other rats after extended training on this kind of procedure. The interaction between the two schedules can be determined by manipulating each schedule in turn and observing the effect on the behavior under the control of the other schedule. For example, if the food reinforcement were not delivered at the end of the 8-min period, the rate of bar pressing would eventually fall to zero whenever the buzzer was on. Any concomitant change in the shock-avoidance behavior would be a consequence of an interaction from the food-maintained behavior. The different character of the rate changes generated by the two schedules of this experiment simplifies the identification of the interactions between them.

More complicated behavioral processes, such as discrimination procedures or other schedules of food reinforcement, could also be used alternately with the avoidance procedure to serve as base lines for the emotional by-products of the avoidance behavior or side effects of analgesic drugs.

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Filament Formation in *E. coli* Induced by Azaserine and Other Antineoplastic Agents

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Azaserine (0-diazoacetylserine) is a new antibiotic that has limited activity against microorganisms but is of great interest because of its ability to inhibit certain experimental neoplasms (1-3).

A remarkable effect of azaserine on the growth of *Escherichia coli* was the induction of the formation of greatly elongated filaments, as are shown (4) in Fig. 1. Examination of these filaments in the phase microscope indicated that they were apparently multinucleate and nonseptate. The length of the filaments varied from a few times to as much as 100 times the length of a normal cell, depending on the time of observation after exposure to the inhibitor. Short filaments could be observed only 30 min after inoculation into azaserine-containing medium.

In contrast to certain other observations on inhibitor-induced filament formation (5, 6), there was no critical level of azaserine at which the phenomenon

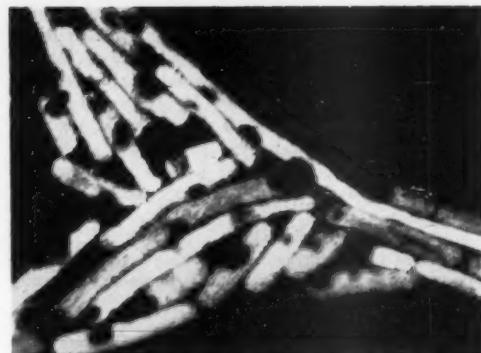


Fig. 1. Electron photomicrograph of filamentous *E. coli* after 5-hr exposure to 0.025 gamma/ml of azaserine. Several organisms of normal length may be seen ($\times 4800$).

occurred. Although detailed correlation of filament length with azaserine level has not yet been made, it was obvious that filaments appeared whether the inhibition was barely significant or almost complete.

The striking nature of this morphological aberration led to the examination of other inhibitors and antineoplastic agents. For most of the growth studies, a salts-glucose medium (7) was employed, but observation of filament formation could be repeated in nutrient (neopeptone) medium. *Escherichia coli* (Parke, Davis Culture Bureau No. 03489) was maintained in the synthetic medium. A 0.1-ml inoculum from an over-night growth was added to 9.0 ml of the medium at 37°C containing the desired constituents, and nephelometric determinations of cell mass were made at hourly intervals for 7 hr. Phase microscopic examinations were made of cultures that were inhibited in the range of 30 to 70 percent.

Under these conditions, the following inhibitors did not cause the formation of nonseptate filaments: chloramphenicol, chlortetracycline, oxytetracycline, streptomycin, sulfanilamide, aminopterin (8), α -methopterin (8), 8-azaguanine (8), glycidol, 2,6-diaminopurine, 6-mercaptopurine (9), ethionine, β -2-thienylalanine, 6-methyltryptophan, isobutyl diazoacetate (9), and diazomalonic ester (9). The following compounds were found to be as potent as azaserine in inducing filament formation: methyl-bis(2-chloroethyl)-amine, triethylenemelamine (8), and 5-diazouracil. Filaments induced by penicillin were characterized by large sphere-shaped vesicles (10), a feature that was never seen in filaments produced by the other inhibitors.

Since this study was made, another report has appeared with illustrations of the filaments induced by nitrogen mustard (11). It has been known for many years that gamma-irradiation of *E. coli* results in filament formation (12).

It has been observed in this laboratory, as well as in another (13), that inhibition of *E. coli* in synthetic media by low levels of azaserine may be reversed by aromatic amino acids. Higher levels of azaserine

Table 1.

Inhibitor	Level (gamma/ml)	Growth* at 7 hr	Addition	Level (gamma/ml)	Growth*, addition only	Growth*, addition + inhibitor
Azaserine	0.025	42	L-Tryptophan	2.5	100	100
Azaserine	.05	0	L-Tryptophan	5.0	100	78
Azaserine	.5	0	L-Tryptophan	50.0	100	21
Azaserine	2.0	0	L-Tryptophan	1000.0	100	8
Azaserine	0.025	52	Cytidylic acid	100	100	63
Azaserine	.025	40	Glutathione	150	100	32
Methyl-bis(2-chloroethyl) amine	1.0	40	L-Tryptophan	100	100	38
Methyl-bis(2-chloroethyl) amine	1.0	40	Cytidylic acid	100	100	36
Methyl-bis(2-chloroethyl) amine	2.0	26	Glutathione	300	84	61
5-Diazouracil	0.5	36	L-Tryptophan	100	100	65
5-Diazouracil	.5	31	Cytidylic acid	5	100	0
5-Diazouracil	.5	38	Glutathione	150	85	74

* Control growth = 100.

become increasingly refractory to this reversal, as is shown in Table 1. Sulphydryl compounds are known to act as protective agents against the effects of radiation and radiomimetic compounds (14). It was discovered in the course of reversal studies that cytidylic acid potentiated the inhibition of *E. coli* by 5-diazouracil, although by itself cytidylic acid had no effect on growth. At the level of cytidylic acid that caused marked potentiation, adenyllic, guanylic, uridyllic, thymidyllic, and desoxyctidyllic acids had no effect. Neither uracil nor uridine, at 100-gamma/ml levels, had any reversing or potentiating effect on the inhibition by 0.5 gamma/ml of 5-diazouracil.

Advantage was taken of these effects of tryptophan, glutathione, and cytidylic acid in an attempt to discover possible interrelationships among the three filament-formers involved, with the results shown in Table 1. Both tryptophan and glutathione appeared to "reverse" partially diazouracil inhibition, indicating possible connections with the modes of action of azaserine and nitrogen mustard. The effect of cytidylic acid on diazouracil inhibition was unique, and glutathione had no effect on azaserine inhibition.

Additional information is available that emphasizes divergencies in the modes of action of azaserine and nitrogen mustard. Azaserine did not reduce the viscosity of solutions of highly polymerized desoxyribonucleic acid, nor did it inhibit rat brain cholinesterase, while nitrogen mustard is very active in both respects (15). On the other hand, the evidence presented here suggests that interference with aromatic amino acid synthesis or utilization may be only one aspect of azaserine activity.

Obviously, such a complex situation calls for many approaches and more penetrating analyses. On the basis of the results so far obtained, it may be concluded that filament formation under the described conditions is not peculiar to antineoplastic agents but can be indicative of a type of cytotoxicity that may or may not be extrapolated with success to mammalian systems. It is hoped that biochemical investigations in progress will make it possible to evaluate further

the significance and possible utility of filament formation in the search for antineoplastic compounds.

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Sucrose Inhibition of Resorcinol Hemolysis

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In a previous electron microscopic study of the surface and interior of erythrocytes in the process of hemolysis, the observed changes suggested that osmotic hemolysis left the erythrocyte ghost elastic, while antibody and complement hemolysis produced a rigid ghost (1). These results were compatible with the different shape and volume changes produced in solution by low osmotic pressure on one hand and various hemolysins on the other hand (2, pp. 26, 82, 245). In general, the hemolysins produce a decrease in surface area followed by an increase to a critical area and volume, different for each agent, at which point hemolysis occurs. One hypothesis to explain this two-stage process would be that the hemolytic agent pro-

Table 1. Resorcinol hemolysis of human erythrocytes—effect of sucrose and glucose.

2.5-percent suspension of RBC in:			Hours*								
Resorcinol <i>M</i>	NaCl <i>M</i>	Sugar <i>M</i>	0.5	1	1.5	2.5	3.5	4.5	7	23	
0.032	0.15		0	0	+	+	+	+	+	+	
0.124	0.15		±	±	++	++	++	++	+++	++++	
0.124	0.15	0.28 glucose	±	±	+	+	+	+	++	++	
0.124	0.15	0.15 sucrose	0	0	0	0	0	0	±	+	
	0.15	0.28 glucose	0	0	0	0	0	0	±	±	
	0.15	0.15 sucrose	0	0	0	0	0	0	±	±	
	0.15		0	0	0	0	0	0	±	±	

* At 25°C for 7 hr, then at 3°C for next 16 hr.

± indicates a trace, and +++ indicates maximal hemolysis.

An isotonic solution = 0.15M NaCl = 0.8M sucrose or glucose = 10 percent sucrose = 5 percent glucose.

duces an increase in the intermolecular surface forces that results in shrinking or folding of the "membrane" with an increased rigidity. The second stage, swelling to the point of rupture, could be explained by an increase in internal osmotic pressure. This can be tested (3) by attempting hemolysis in a solution made hypertonic with nonpenetrating molecules such as sucrose. Resorcinol was chosen as the test hemolytic agent because it allows a volume increase before hemolysis greater than that produced by most other agents, including antibody and complement (2, p. 240).

In the first of these preliminary experiments, varying concentrations of resorcinol (1,3-benzenediol) were added to 2.5-percent suspensions of washed human red blood cells. The NaCl concentration was maintained at 0.15M (isotonicity). The degree of hemolysis was estimated from 0 to +++ by the volume of sedimented red cells and the color of the supernate. Results typical of a series of tubes are shown in Table 1. Human red cells are hemolyzed by resorcinol in a manner suggested by the general S-shaped hemolysis-time curves discussed by Ponder (2, p. 176). At low resorcinol concentrations, a small amount of hemolysis occurred in 1.5 hr and did not progress further during the experiment. Larger concentrations produced more rapid and more extensive hemolysis. Resorcinol hemolysis is com-

pletely inhibited by 5 percent sucrose (0.15M) in isotonic saline. Five percent glucose (0.3M) under similar conditions showed only moderate inhibition, which could be explained by the specific active transport of glucose into human red cells (4).

In the next experiments, a few representative results of which are shown in the upper half of Table 2, it was found that hypertonic sucrose solutions would also prevent resorcinol hemolysis of rabbit red cells. Sodium chloride at the same osmotic pressure does not prevent resorcinol hemolysis but does slow it. This partial inhibition by a slowly penetrating ionic substance is compatible with an osmotic effect and suggests that the sugars do not need to act by virtue of their chemical similarity to one another and to resorcinol. Lowering the temperature from 26° to 3°C delays hemolysis.

In the third set of experiments, the sucrose concentration was varied. The results of two of these are shown in the lower half of Table 2. Most solutions of 1 percent sucrose (0.030M or 0.1 isotonic) in isotonic NaCl and higher concentrations of sucrose completely inhibited resorcinol hemolysis of rabbit erythrocytes in the experimental period; 0.025M sucrose and gradually decreasing concentrations down to 0.005M permitted increasing rates of hemolysis.

The results are entirely compatible with the original

Table 2. Resorcinol hemolysis of rabbit erythrocytes—effect of temperature, hypertonic NaCl, and sucrose concentration.

2.5-percent suspension of RBC in:			Hours							
Resorcinol <i>M</i>	NaCl <i>M</i>	Sucrose <i>M</i>	0.16	0.5	1	1.5	2	2.5	3	
0.124*	0.15		0	0	0	+	++	+++	++++	
0.124	0.15		0	±	++	+++	+++	+++	+++	
0.124	0.07	0.6	0	0	0	0	0	0	0	
0.124	0.37		0	0	±	±	+	++	++	
0.124	0.15		0	0	0	+	++	+++	+++	
0.124	0.15	0.010	0	0	0	±	+	++	++	
0.124	0.15	0.030	0	0	0	0	0	0	0	

* At 3°C; the other results are at 25 to 26°C. pH of resorcinol tubes 6.8 to 6.9.

Controls with equivalent amounts of sucrose and NaCl showed no hemolysis.

The last three rows were determined with a different suspension of red cells at a different time.

hypothesis, although other effects of the hemolytic agent on the structure of the cell cannot be ruled out. Inhibition of saponin or bile salt hemolysis by various sugars in isotonic solutions has been described and the possible influence of reduced ionic strength discussed (2, p. 274). The sucrose inhibition of the present experiments is effective even with the ionic strength maintained constant. An increased internal osmotic pressure produced by a hemolytic agent might be due to (i) an increase of ions in the interior of the cell consequent to the loss of differential membrane permeability, or (ii) dissolving normally insoluble or structurally bound internal macromolecules. Experimental support of the first factor has been advanced by several investigators (5, 6, 7). However, a low concentration of resorcinol will allow marked cation shifts with only a little swelling (2, p. 244). The second possibility has apparently not yet been investigated, but it is noteworthy that the excess osmotic pressure, 0.1 isotonic, of the lowest sucrose concentration completely inhibiting resorcinol hemolysis in these experiments corresponds exactly to the osmotic pressure calculated for hemoglobin in red cells by Wilbrandt (7). Further work is being done to elucidate these mechanisms with quantitative volume and percentage hemolysis determinations.

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An Earlobe Algesimeter: A Simple Method of Determining Pain Threshold in Man

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A dependable and reproducible method for determining pain threshold is essential in the quantitative evaluation of analgesic drugs. Thermal radiation and electric stimulation of the tooth pulp, two commonly used methods, have recently been criticized (1-3), because the results obtained have not been uniformly reproducible even in trained subjects. Faradic stimulation, for the determination of pain threshold, was

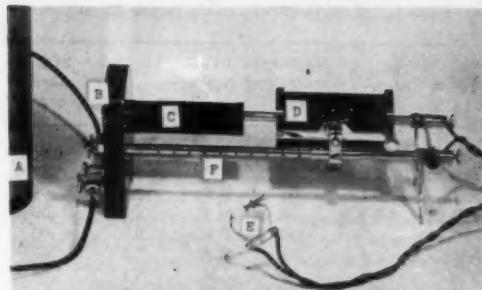


Fig. 1. Inductorium for determination of pain thresholds: A, battery; B, circuit breaker; C, primary coil; D, secondary coil; E, earpiece; F, calibrated scale.

first clinically investigated by Martin *et al.* in 1913 (4-7). Macht and his associates (8) in 1915 used an inductorium to study quantitatively the analgesic action of opium alkaloids in trained subjects. It is the purpose of this paper to describe the use of the inductorium for the determination of pain thresholds in untrained subjects and to introduce the earlobe as the site of stimulation.

The apparatus (Fig. 1) consists of a standard inductorium connected to a 1½-v dry cell battery. The primary and secondary coils are identically wired. A simple key is interposed between the battery and inductorium. Direct interrupted current is obtained through an electromagnetic circuit breaker. With the help of an electrocardiograph, the circuit breaker was regulated to produce faradic current of 60-cy/sec frequency. An adjustable earpiece is connected to the secondary coil of the inductorium.

The investigation was carried out on 12 male and 12 female untrained volunteers whose ages ranged from 21 to 36 yr. The subject lay on a bed in a quiet room and was allowed to rest for 20 min before the testing began. The earpiece was then applied to one of the earlobes and the screw was adjusted until good contact without discomfort was obtained. The secondary coil was then moved at a uniform slow speed toward the primary coil, and the subject was familiarized with the sensations of vibration, prickling, and sudden sharp pain (the end-point), which occur successively as the secondary coil is advanced. The volunteer was instructed to signify immediately the onset of the sharp pain. After this preliminary trial, 10 tests were carried out at 3-min intervals on each subject. The position of the secondary coil at the moment of response was read from the calibrated scale; this figure was taken to represent the pain threshold. After the 10 tests, one similar test was carried out on the other earlobe. During the experiments, the subjects could not see the markings on the scale, nor were the results discussed with them. All the tests were performed by the same investigator (M.S.).

Table 1 shows the means and standard errors of pain thresholds obtained in the male and female groups. The single test on the contralateral ear fell

Table 1. Pain threshold values in the 24 subjects.

Males	Threshold	Standard error	Females	Threshold	Standard error
E.L.	8.5	.13	J.G.	6.4	.06
R.E.H.	7.9	.05	P.C.	7.8	.10
J.R.	6.7	.05	D.Q.	7.1	.03
F.R.P.	7.4	.04	M.V.	8.0	.05
B.O.	7.5	.03	T.H.	6.6	.06
J.P.K.	8.6	.07	M.S.	7.3	.05
N.M.P.	8.0	.04	J.M.	8.1	.03
R.S.V.	8.1	.07	T.F.	7.4	.04
J.G.	7.2	.05	N.K.	8.3	.06
S.L.	8.0	.05	L.L.	8.9	.10
M.S.	7.8	.04	I.D.	7.8	.09
E.H.	7.8	.01	M.P.	7.7	.07

within the range of the standard deviation in every case. The mean and standard error for the male and female groups were 7.7 ± 0.16 and 7.6 ± 0.20 , respectively.

With the method of algometry described, it was observed that the end-point is sharp eliciting of a spontaneous response. The range of the standard errors of the pain-threshold determinations made on the same individual suggests a highly significant degree of reproducibility. The variation in pain thresholds between different subjects was of a low order, and no significant sex difference was observed. The apparatus is compact, simple to use, inexpensive, and requires no special training on the part of the operator. Furthermore, reliable results can be obtained in untrained subjects.

The ear lobe as the site of stimulation appears to be advantageous, because it has a relatively uniform thickness in different individuals and is composed only of skin, areolar, and adipose tissues. The anatomy of the earlobe permits passage of the stimulating current through its entire thickness; the stimulus is therefore more uniform than in methods where surface stimulation is applied. This method is currently being employed to investigate the effects of Nisentil® on pain threshold in man.

Since the time that this paper was accepted for publication, it has come to our attention that a similar method, utilizing electric stimulation of the earlobe, has been employed by Hofmann and his co-workers (9) for the study of the changes in pain threshold caused by various combinations of analgesic drugs.

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Radiation-Induced Chlorophyll-less Mutants of *Chlorella*

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Although many physiologic investigations have been made of *Chlorophyceae*, particularly *Chlorella*, there are very few publications on genetic variation in this group. Reports of chlorophyll-less mutants have been confined to species of *Chlorella*.

Beijerinck (1) reported the natural occurrence of yellow and colorless colonies of *Chlorella variegata* on culture media. This observation was later confirmed by Meyer (2), who attributed the presence of yellow and colorless forms to variation within the normal green colony. Recently Granick (3) induced colorless, pale yellow, and light green mutant colonies in *C. vulgaris* with x-rays. The present paper (4) presents the preliminary results of exposing cells of *C. pyrenoidosa* to ultraviolet light and the characterization of certain resulting mutants.

An isolate of *C. pyrenoidosa* obtained in pure culture from a single cell was used in this study. The cells were grown in continuous light in broth containing beef extract, tryptose, glucose, and sodium nitrate. A suspension of cells was prepared from cultures 7 to 10 days old by decanting the broth and adding distilled water. Fifteen milliliters of this suspension was pipetted into a Petri dish and exposed, at a distance of 3 cm, 1 to 4 min to ultraviolet light from a Westinghouse type SB Sterilamp. Cells were then distributed on the surface of agar plates and incubated in diffuse daylight for 3 wk.

Mutations were observed for the following characters: rate of growth, topography, and color of the colony; starch synthesis, plastid formation, and cell size. This report deals especially with induced changes in cell pigmentation.

Mutant colonies from the parent (C-1) were of lighter tints of green. Green colonies with yellow sectors and dwarf colorless colonies appeared frequently, but cells from these nongreen areas did not grow when transferred to fresh medium. C-1 was very stable in culture and rarely gave rise to color mutations, either naturally or through the use of a mutagen. On one occasion, however, two yellow colonies were obtained from an aging culture, but in subsequent analysis of cell populations from cultures up to 5 mo old no color mutations were found.

A light green mutant, CM-1, obtained from the parent produced mutants when exposed to ultraviolet

Table 1. Characteristics of parent and mutant lines in diffuse daylight on meat extract-tryptose medium.

Parent and mutants	Colony color	Range in cell size (μ)	Typical auto-spore formation	Plastid formation	Starch synthesis
Parent					
C-1	green	2.0-3.5	+	+	Normal
Mutants					
CM-5	yellow	2.0-3.5	+	+	Normal
CM-24	white	3.0-11.0	+	+	> Normal
CM-29	white	3.0-7.0	+	-	Normal
CM-30	white	3.0-7.0	+	+	None

* + indicates presence; - indicates absence of character.
† Cells stained with crystal violet and examined at approximately 1000 magnification.

light similar to those produced by C-1. Neither yellow nor white colonies were obtained from this line. It did, however, give rise to CM-3, a light olive-green mutant, which in turn produced several yellow colonies after treatment. One such yellow mutant, CM-5, yielded white, red, and green colonies after exposure to ultraviolet light. A white mutant, CM-24 (Table 1), gave rise spontaneously to a pale yellow mutant, CM-35. This yellow line mutated to light green after exposure to ultraviolet light. Thus it was possible to induce white mutants, apparently without chlorophyll, stepwise from the green parent. It was also possible to obtain green colonies similar to the parent stepwise from the white lines.

White mutants CM-29 and CM-30 were stable in culture, but this was not true for most of the yellow and light green mutants. When maintained on beef extract-glucose agar, particularly in light, cultures tended to revert to the color of the line from which they were immediately derived. This difficulty of maintaining pure stocks was overcome by growing variable lines on a medium composed only of inorganic salts and glucose.

Like the parent, C-1, colorless mutants reproduce by autospores. In this process the cell protoplasm divides to produce a tetrad of cells. Although the tetrad is transitory, two cells of different size may adhere in such a way to make it appear that cell multiplication is by budding or fission. The protoplasm frequently divides to produce only two globose spores that lie free within the wall of the parent cell.

The white mutants occasionally formed filamentous cell protrusions similar to the fusion tubes of certain yeasts. These tubes were 1 to 2 μ in diameter and approximately 2 to 4 μ long. Other morphological

characters of selected mutants are summarized in Table 1.

Chlorophyll-less mutants were not deficient for vitamins or other growth factors. All the lines grew rapidly in a medium comprising inorganic salts and glucose. In the dark, the parent and mutants (Table 1) behaved similarly in sugar assimilation tests. Glucose and galactose were strongly assimilated, lactose and maltose weakly, and sucrose was not utilized. Fermentation tests with these sugars were negative. Nitrate and nitrite nitrogen were utilized by C-1 and by the white lines, but growth was sparse when cultures were supplied with either asparagine or ammonium chloride.

Permanently colorless forms analogous to the colorless mutants of *C. pyrenoidosa* have been reported from nature. These forms have been referred to the genus *Prototheca*, which was created in 1894 by Krüger (5) to accommodate two unicellular organisms that he considered fungi. Krüger (5) pointed out the close resemblance of *Prototheca* spp. in form and development to certain lower green algae, particularly to such forms as *C. vulgaris* Beijerinck. A comparison of the white mutants (Table 1) with *P. chlorelloides* obtained from the University of Indiana culture collection confirmed the similarities in ontogeny and morphology of the two genera. Since the species of *Prototheca* are alga-like in their reproduction and show no direct connection with existing groups of fungi, they have been regarded by some phycologists as colorless algae.

It may be inferred from the results presented in this paper that the colorless forms of the genus *Prototheca* could have arisen by mutation from the *Chlorophyceae*. Indeed Beijerinck (1) assigned a colorless mutant of *C. variegata* to a new species *P. kruegeri*. In his opinion this was a transition from an alga to a fungus.

It has not been possible to study the range of potential characters that may be produced in the colorless mutants. Studies are therefore being continued to determine the limits of genic variation and phenotypic variability.

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Communications

How Legitimate Are Names on Scientific Papers?

Are names on technical papers legitimate? Or are names on technical papers a perversion of the ideal of selfish devotion to science?

Is it not true that much of the competition for better jobs, the social climbing, the commercializing, the getting ahead in one way or another in the scientific world, has come to be channeled into the competition to get names on published papers? Is it possible that science now tends less to involve the high-minded search for knowledge than a mad scramble to get one's name in print?

Getting promoted depends on the number of papers you have published.

At my university promotions are based on the number of papers. Either we get papers out or get out!

We hire our people on the strength of papers published.

He's a comer, and he doesn't care who knows it. He puts down what everybody knows pretty well and sends it in. Since nobody else has written it up, he gets his name on it.

That material had no business being printed. A man'll do anything to get his name in print these days.

Everybody in the chain of command gets his name on every project that goes through his hands, whether he actually did any of the work or not. After all, wasn't he responsible, and hasn't he got to get his name in print just like everybody else?

So a man scrambles to get his name on papers. He has a living to make. He did not make this system, but he does have to live by it. If you do not like the system, what are you going to do about it? Like the displaced sharecropper in the *Grapes of Wrath*, who are you going to shoot? There is no person, organization, journal, or particular school of scientists that one can blame. It is all a part of the present competitive system. Whether scientists like it or not, the competitive spirit is now being applied to science no less than to business and industry.

In the sense that men are working for recognition, either socially or economically (which is also socially of course), these names are more defensible on papers than in the sense of credit due for work done. No scientist today works in a vacuum. By and large, neither his basic ideas nor what he does with these basic ideas originate with him. This is true in two senses:

1) Most research today is team research. A problem is broken down into its various phases; each phase is assigned to one man or several men. Periodically, once a day, week, or month, men on the project will get together to discuss the work, exchange ideas, decide what task to take.

2) The material worked with is picked up from the literature. Published reports and journal articles

spread scientific ideas and theories, facts and figures, broadcast over the entire world. Science as practiced today would be impossible without this wholesale exchange. Often the wilder the ideas, the better. Ideas may be "wild" only because brains, manpower, and money have never been applied to bring them to fruition.

Any one man really owes no more than an exceedingly small amount to his own efforts. One can trace for oneself how much Einstein, Bohr, Dirac, Heisenberg, Born, and Planck originated for themselves and how much they owe to the work going on around them. The contribution of these men lies in their giving a new twist, or in integrating into a unified system, a heterogeneous mass of scientific material. To over-emphasize the importance of their work is to belittle the achievements of all competent scientists.

The accent must be on the desire to pass along what has been discovered and worked out, not on getting one's name in print. This is the accent that the true scientific spirit must propagate. There is nothing inherently discreditable in men's names appearing on their papers. The mad scramble for credit, however, as demonstrated by the haste to get names on papers, cannot by any stretch of the imagination be said to be in the scientific spirit. Whoever gets the credit for the work done, this perversion of the scientific spirit cannot be to the credit of science.

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12 July 1954.

Pressor and Central Stimulant Properties of a Serotonin "Antagonist"

The pharmacology of 2-methyl-3-ethyl-5-aminoindole (MEAIN) is of interest because the compound was prepared (1) as an analog of serotonin (5-hydroxytryptamine). This aminoindole and a congener have been used to analyze the effects of serotonin, but certain reservations concerning the specificity of the effect should be suggested, since the compound appears to have sympathomimetic activity.

In dogs anesthetized with sodium pentobarbital, the aminoindole itself has a marked pressor effect, as Page and McCubbin (2) have shown. The effect varies unpredictably with the rate of administration and the concentration of the injected solution, possibly as a function of its limited solubility. If a dose of 1 mg/kg is injected as a 0.1 percent solution in saline over a period of 50 sec the rise in mean blood pressure is 30 to 60 mm of mercury. More important, the pressor effect is abolished but not reversed by previous administration of an adrenergic blocking agent (piperoxan, 4 mg/kg). Respiratory stimulation and greater pulse pressures appear irregularly in normal dogs

after the small doses used but are marked in animals in the shocked state induced by acute reduction of cardiac output. Robson and others (3) report that the closely related 2,3-dimethyl-5-aminoindole inhibits carbachol stimulation of the isolated, diestrus uterus, another fact that suggests a sympathomimetic action.

MEAIN in large enough doses (100 or more times the challenge dose of serotonin) does prevent the pressor response to serotonin but not the reflex effects (1). However, the same is true of ephedrine for the duration of its pressor effect. Moreover, the direct vascular effect of serotonin is enhanced after the blood pressure has returned to normal following a single injection of ephedrine or during a tachyphylactic state following repeated doses of ephedrine, further indicating the effect of altered vascular reactivity.

These observations, which suggest an ephedrine-like activity of MEAIN, appear to be applicable also to a 2-methyl-3-ethyl-5-dimethyl aminoindole (Medmain). The toxicity of this compound, given intraperitoneally to mice in doses that approximate 150 to 300 mg/kg (5 to 10 mg per mouse), impresses Woolley and Shaw (4) as being "remarkably similar to the seizures of human epilepsy," but the description also parallels closely the description of ephedrine toxicity (5, 6), if one substitutes respiratory stimulation for hyperventilation and tonic convulsion for opisthotonus. It is doubtful whether the pharmacologic properties of this substance are specific enough to permit inferences about the genesis of disease entities (7).

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Peculiar Physiological Behavior in Rice (*Oryza Sativa*)

A wide disparity in the flowering time of the parents is one of the chief handicaps of a plant breeder for hybridization in rice or, for that matter, in any crop. The usual methods adopted by breeders to synchronize flowering time are (i) periodical sowings, (ii) photoperiod treatment, and (iii) seed vernalization. Although the first method is simple, the second and third are cumbersome, time-consuming, and expensive. In a search for a simpler method of synchronizing

Table 1. Mean flowering duration in days.

Pot size (in.)	Number of seedlings per pot			Mean
	One	Two	Three	
1950-51 results				
6	150.4	148.2	159.0	152.5
9	141.8	145.2	146.0	144.3
12	131.6	137.6	139.2	136.1
Mean	141.3	143.6	148.1	
Critical difference for comparing: means within a treatment, 2.39; marginal means, 1.38.				
1951-52 results				
6	136.4	147.8	148.2	141.1
9	121.2	144.0	151.8	139.0
12	125.4	137.6	136.2	133.1
Mean	127.7	143.1	145.4	
Critical difference for comparing: means within a treatment, 6.64; marginal means, 3.83.				

flowering, an interesting physiological phenomenon was encountered.

In the (1950-51) second crop season (Nov.-Apr.), 30-day-old seedlings of a rice variety from Madras (G.E.B.24) were transplanted in different-sized pots with varying numbers of seedlings. Pots with face diameter and height of 6, 9, and 12 in. were used; and one, two, or three seedlings were transplanted in each pot size. There were nine treatments with five replications. The time of first flowering for each treatment was noted. The experiment was repeated in the 1951-52 second crop (Nov.-Apr.) season. The results obtained are given in Table 1.

The 2-yr experiment results show that (i) the flowering duration is delayed by reducing the size of the pots from 12 to 6 in., (ii) the flowering duration is delayed by increasing the number of plants per pot from one to three, and (iii) the maximum difference in flowering duration is obtained between treatments growing only one plant in the largest pot size and three plants in the smallest pot size, the difference observed being 23 to 27 days.

To ascertain whether the flowering-time difference in different pot sizes was due to the volume of soil contained in each, the following experiment was conducted. The ratio of the volume of soil held by pots of face diameter 9, 12, and 15 in. is 1:4:7. Hence in 9-in. pots, one rice plant was transplanted; in 12-in. pots, four plants; and in 15-in. pots, seven plants. There were six pots of each size. The time of first flowering was noted in each case.

That the nutrients contained in the soil do determine the flowering duration is clear from Table 2, wherein for a unit volume of soil per plant, the flowering occurs almost simultaneously. Horticulturists (1) hold that the higher the level of nutrition available, the better will be the vegetative growth and the longer the commencement of the reproductive phase is postponed. With a lower level of nutrition, plants flower earlier. Nitrogen manuring on some of the cereals of the temperate region has a similar effect (2). But nothing

Table 2. Results obtained by giving equal volume of soil for each plant.

Pot size, face diameter and height (in.)	No. of plants per pot	Mean flowering duration (days)
9	1	135.3
12	4	130.1
15	7	131.7

Critical difference for comparing two-treatment means, 21.51.

seems to have been noted in the case of rice, a tropical crop. On the view that a lower level of nutrition hastens flowering, the 6-in. pots with three plants in each should flower earlier than 12-in. pots with one plant in each, since the quantity of nutrients available per plant must be much lower in the former case. Still the latter comes to flower earlier than the former, contrary to expectations. This may be due to one of the following reasons: (i) starvation does hasten flowering up to a particular nutritional level, beyond which the heading time is delayed, or (ii) the principle that starvation hastens flowering does not hold good for rice. Whichever contention is correct can be verified only by further experimentation. Facilities for sand culture do not exist at this institute. It is hoped that work in institutions where such facilities exist can clarify the position.

The finding that a difference of more than 3 wk in the time of flowering can be obtained by manipulating the number of plants in different-sized pots and should be a useful addition to the methods employed for overcoming the difficulty of crossing period-fixed varieties of different durations.

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7 December 1953.

Emeritus House*

I have had more than half-a-century of experience in the field of glass technology and research and still study the current literature daily. I have, during this period, produced or improved practically all types and colors of glass. Since my retirement from teaching in the fall of 1951, I have had to engage in consulting practice to augment inadequate retiring allowances,

social security, and annuities. This is not a complaint, for my wife and I are able to live as well as we did on my teaching salary. Also, the work is interesting. However, posterity will be deprived of the fruits of my experience, unless their recording is rendered possible through subsidies that would enable me to devote my time to writing and would provide the necessary secretarial facilities. With 46 years of experience in the teaching of chemistry, a volume, or volumes, on "The Chemistry of Glass" should result. At present, there are no books of this title, and only occasional individual papers have appeared in science journals.

What has been cited is only one of many cases in which capable and experienced individuals, who have treasures to record for posterity, either cannot afford to do so, or lack the facilities. What shall we do to conserve this precious knowledge?

It is my thought to establish what I choose to christen "Emeritus House." Such a building purchased or constructed near a high-class library center would furnish office and study facilities for professors emeriti, who should be selected by a competent screening committee consisting of active authorities in various branches of the arts and the sciences. These terms are used in a very broad sense instead of listing the many possible fields encountered in education. Capable clerical and secretarial help and equipment that would facilitate the recording of findings should be provided. Another screening committee could evaluate the literature that is created and decide whether a project should be continued. If approved for publication, arrangements should be made for the private or licensed printing of recordings.

What about the financing of such a project? It is my thought that a haven for creative work should be subsidized by industry (a real beneficiary in the fields of science, technology, economics, and so forth), by interested individuals, and by foundations. I use the term *subsidized*, advisedly. Endowments bring returns that vary, and they alone are too uncertain. Let us remember that in some worthy cases it may be necessary to afford salaries or subsistence grants to appointees. Above all, it is essential to let these savants devote themselves, carefree, to their work.

After the establishment of the first "Emeritus House," say in Pittsburgh, a leading industrial center of the world, other "Emeritus Houses" could be created in other centers all over the United States. They should furnish a precious literature for those lovers of democracy who wish to perpetuate the good and the fine things of life.

This recommendation merely suggests a principle. It makes no pretext of covering the numerous details that must be considered by those who would plan and establish "Emeritus House."

ALEXANDER SILVERMAN

*Emeritus Professor of Chemistry,
University of Pittsburgh*

* A paper presented before the Pennsylvania Academy of Science, in Pittsburgh, 17 Apr. 1954.

23 April 1954.

Kodak reports to laboratories on:

a new optical element...a tip for x-ray diffractionists...
spectrophotometric solvents for the infrared

Axicons

The axicon has been invented. To the lens, the prism, and the mirror—the basic elements of optical design—there has been added the axicon. It could have been invented in 15th-century Florence, or in Restoration England for presentation at an early session of the Royal Society, but it wasn't. It was invented in no garret, but in this bright and shining factory overlooking the Genesee River in Rochester, N. Y.,



by John H. McLeod, a Kodak optical engineer. This is incredible. Our times seem far too complex, our science and technology far too advanced for a man to invent anything as simple as the axicon in the sixth decade of the 20th century.

But listen to Doctor McLeod:

"A search for a universal focus lens has led to a new class of optical elements. Probably the most important of them is a glass cone. This class has the common property that a point source on the axis of revolution is imaged to a range of points along the axis. Such elements do not, therefore, have a definite focal length. The word 'axicon,' meaning axis image, has been coined to cover this type of element. [Note: He had to coin a word. There just wasn't any existing word to serve the purpose.] Axicons form images only of small, bright objects.

"One application is in a telescope. The usual spherical objective is replaced by a cone. This axicon telescope has no focusing movement

but is in focus for targets from a foot or so to infinity. It can simultaneously view two or more targets placed along a line.

"If a light source is added to the telescope with a suitable beam splitter, it becomes an autocollimator. It can do more than an ordinary autocollimator, however, for, in addition to checking the perpendicularity of a mirror, it can simultaneously view one or more targets along the line of sight. [He means more than "view." At a distance of 100 feet, the position of a target can be determined to .001", and even a non-technical executive has done it. In angle, this means an accuracy of 1/5 second.]

"A useful form of axicon is a reflecting cone. It will return an image of a point source back to the source over a range of distances depending on the cone design. This form may



be used for the precision checking of lathe beds and the like, or for checking the flatness of surface plates."

If you would like to use a line of light in space as a tool, get in touch with Eastman Kodak Company, Special Products Sales Division, Rochester 4, N. Y.

Advice on diffraction

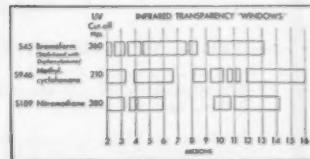
We can perform a slight but perhaps useful service for practitioners of x-ray diffraction by showing how to get rid of one of the two images on opposite sides of *Kodak Industrial X-ray Film, Type K*. This film, though made for industrial radiography, happens to be our fastest for

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2. Programs of the 18 AAAS sections (symposia and contributed papers).
3. Programs of the more than 70 participating societies.
4. The Special Sessions: AAAS, Academy Conference, Third Berkeley Symposium on Mathematical Statistics and Probability, Conference on Scientific Editorial Problems, National Geographic Society, Pacific Science Board, Phi Beta Kappa, Phi Kappa Phi, RESA, Sigma Xi.
5. Details of the Gymnasium for Men—center of the Meeting—and campus.
6. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
7. Exhibitors in the 1954 Annual Exposition of Science and Industry and descriptions of their exhibits.

Directory content

1. AAAS officers, staff, committees for 1954.
2. Complete roll of AAAS presidents and their fields.
3. The 260 affiliated organizations.
4. Historical sketch and organization of the Association; the Constitution and Bylaws.
5. Publications of the Association.
6. AAAS Awards and Grants—including all past winners.
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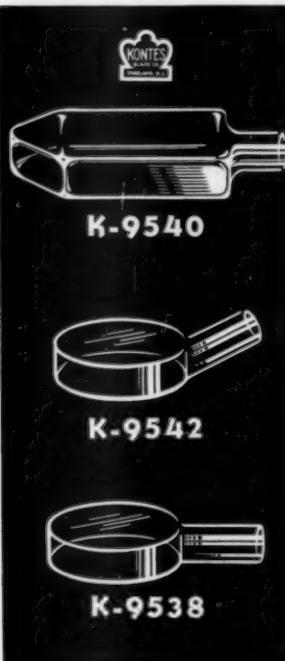
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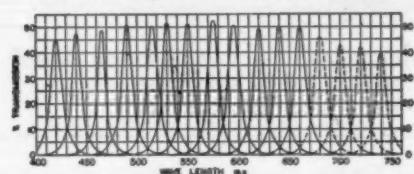
September

- 5-10. Laurentian Hormone Conf., Mont Tremblant, Que., Canada. (G. Pineus, 222 Maple Ave., Shrewsbury, Mass.)
6-8. Symposium on Inorganic Chemistry, IUPAC, Münster, Germany. (R. Delaby, 4 Ave. de l'Observatoire, Paris 6.)
6-9. American Forestry Assoc., annual, Portland, Ore. (AFA, 919 17 St., NW, Washington 6, D.C.)
6-9. Conf. on the Physics of the Ionosphere, Cambridge, England. (J. A. Ratcliffe, Cavendish Laboratory, Cambridge.)
6-10. International Conf. of Geographic Pathology, 5th, Washington, D.C. (R. A. Moore, School of Medicine, Washington Univ., St. Louis 10, Mo.)
6-10. International Cong. of Clinical Pathology, 2nd, Washington, D.C. (R. A. Moore, School of Medicine, Washington Univ., St. Louis 10, Mo.)
6-10. International Poliomyelitis Conf., 3rd, Rome, Italy. (S. E. Henwood, 120 Broadway, New York 5.)
6-11. International Soc. of Hematology, 5th, Paris, France. (S. Haberman, 3600 Gaston Ave., Dallas, Tex.)
7. Phytochemical Soc. of America, Gainesville, Fla. (R. H. Thompson, Dept. of Botany, Univ. of Kansas, Lawrence.)
7-10. Alaska Science Conf., 5th, Anchorage, Alaska. (AAAS, Box 960, Anchorage.)
8-9. Soc. of General Physiologists, annual, Woods Hole, Mass. (J. B. Buck, National Institutes of Health, Bethesda 14, Md.)
8-10. American Physiological Soc., Madison, Wis. (W. B. Youmans, Dept. of Physiology, Univ. of Wisconsin, Madison.)
8-10. American Soc. of Mechanical Engineers, fall, Milwaukee, Wis. (O. B. Schier, II, 29 W. 39 St., New York 18.)
8-10. American Sociological Soc., Urbana, Ill. (J. W. Riley, Jr., A.S. Soc., New York Univ., New York 3.)
9-11. American Political Science Assoc., annual, Chicago, Ill. (J. Gage, 1785 Massachusetts Ave., NW, Washington 6, D.C.)
9-17. International Cong. of Ophthalmology, 17th, Montreal, Canada, and New York, N.Y. (W. L. Benedict, 100 First Avenue Bldg., Rochester, Minn.)
10-12. Gerontological Soc., Gainesville, Fla. (A. J. Carlson, Univ. of Chicago, Chicago 37.)
10-13. Econometric Soc., Montreal, Canada. (R. L. Cardwell, Cowles Commission, Univ. of Chicago, Chicago 37.)
10-13. Inst. of Mathematical Statistics, American Statistical Assoc., and Econometric Soc., Montreal, Canada. (K. J. Arnold, Dept. of Mathematics, Michigan State College, East Lansing.)
10-16. International Symposium on Problems in Contemporary Optics, Florence, Italy. (S. S. Ballard, The Rand Corp., Santa Monica, Calif.)
11-19. International Cong. of Industrial Chemistry, 27th, Brussels, Belgium. (Mr. Guilmot, 32 Rue Joseph II, Brussels.)
12-16. American Inst. of Chemical Engineers, Glenwood Springs, Colo. (C. H. Prier, Research Inst., Univ. of Denver, Denver 10, Colo.)
12-17. American Chemical Soc., annual, New York City. (R. M. Warren, 1155 16 St., NW, Washington 6, D.C.)
(See issue of 16 July for more comprehensive listings.)

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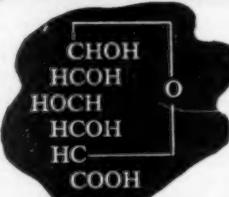
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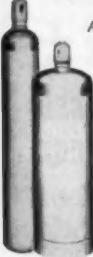
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